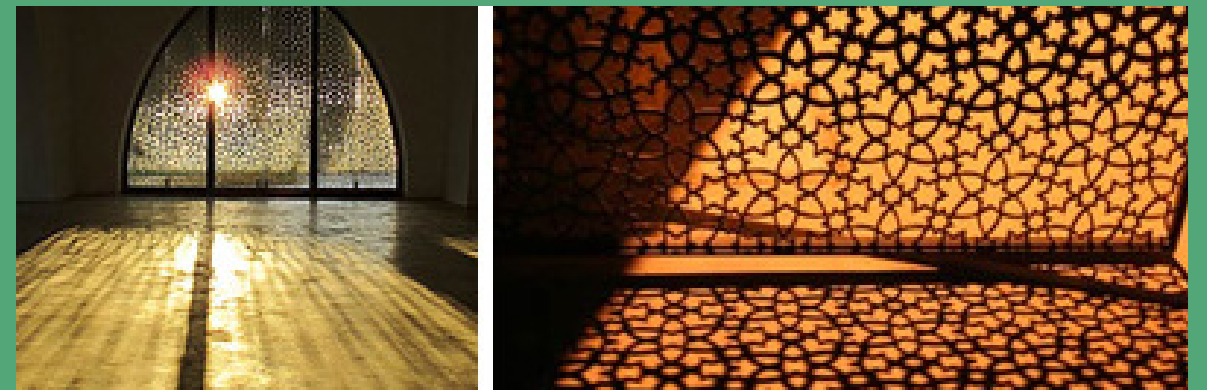


Volume 1: Master Plan Strategy
Holistic Approach and Technical Recommendations
Stage 1



SUMMARY

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SUMMARY

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1. INTRODUCTION

2. HOLYSTIC APPROACH

A successful lighting strategy is one that crosses boundaries, viewing the 'public realm' analyzing the urban dynamics, the people's needs and traffic.

Public Transportation, Pedestrian Route Traffic, Cycle Route, are the principal facts for identifying the LUMINOUS ENVIRONMENT, needed for each place.

3. NORMS/MUST: TECHNICAL RECOMMENDATIONS

The lighting strategy has been designed for the compliance of the lighting norms, evaluated for this master plan, derived from;

CIE. (Comission Internationale de Eclariage).

The Central Bureau located in Vienna, Austria, with comprised of 38 member bodies. Argentina, Australia, Belgium, Canada, China, Denmark, France, etc.

IESNA. (Illuminating Engineering Society Of North America).

The Society is still headquartering in New York. With comprised of Canada, USA, Mexico, Alaska.

EN. (European Committee for Standardization).

- Was officially created in Brussels. With Comprised of European Union Countries.

Showing the MUST levels for each area.

4. LIGHTING MASTER PLAN STRATEGY

STREETS

A) LUMINOUS ENVIRONMENT

Determine the manner in which the viewer perceives the site which is being treated. Specific luminous environments will be recreated in the different spaces. In order to provoke certain reactions in the spectators, each area deserves a different lighting treatment.

Different environments will result from combination of light, shadows and color, therefore enabling the user to experience different emotions.

B) LUMINAIRE TYPOLOGY

Select the lighting fixture heights, directions and rhythms.

ARCHITECTURE

Our environment is shaped by buildings. It is shaped by sweeping, monotonous façades just as much as by architecturally inspiring and important façades. Architecture is set centre-stage by selectively illuminating individual details, shapes and structures or by harnessing uniform, wide-area lighting.

STREETSCAPE

Streetscaping recognizes that streets are places where people engage in various activities, including but not limited to motor vehicle travel.

Pedestrian's and Driver's experience is strenghtened by lighting up all the trees along the street in the Magnificent Streetscape, as well, but as an accent light way in the Convivial.

Streetscape. In both cases, lighting up the trees will enhance the sense of greatness of the city and the overall perspective.

While in the residential areas, our strategy is to light up the street, but not the trees, in order to promote low lighting levels in the vertical planes and avoid intrusive light inside the buildings.

In regard to the Roundabouts and Crossroads, the proposal is to stand out this areas adding accent lighting in the landscape in order to convert them in a focal point in the street.

LANDSCAPE

The presence of trees and greenery in urban environments add a special character to the mood of the space. For this reason the lighting design of these special elements has to be carefully studied in order to integrate them in the general atmosphere characteristic of the area.

5. LIGHTING APLICATION

STREET LIGHTING

A street light is a raised source of light on the edge of a road or walkway, which is turned on or lit at a certain time every night.

In the coordination of a large Lighting Master Plan, such as Lusail, it is hightly important work within a comprehensive design framework, so that the city can be read as a unit, with a cohesive and uniform design that can identify both, within and from outside the city.

FACADE LIGHTING

Lighting at night in the Facades can contribute considerable to the character and vitality of the

city, besides the iconic night image of the city. Lightng the vertical planes, allows the city to show its architectural essence, volume, texture and color, giving a clear view of their hierarchy in the master plan.

6. SUSTAINABILITY

The LMP of Lusail engages on the city study in order to offer best lighting solutions and techniques in terms of quality, maintenance, energy efficiency and lighting control. Therefore, our lighting solutions will result a high quality implementation with right luminaire choice and appropriate lighting levels for particular uses. Our lighting design principles are based on energy efficiency recommendations and also offer a wide knowledge about the state of the art of new technology lighting-control performance. Furthermore, we will take in account only the long-term suitable equipment to achieve very low maintenance needs.

1. INTRODUCTION

GOOD LIGHTING - THE SEARCH FOR A CONSENSUS

The intention of this guide is therefore to evaluate Light as an essential element in the experience of the forms and places that surround us. It's orchestration and design will determine the degree of enjoyment and appreciation.

Architects are familiar with lighting of a building but on a broader scale such as the city, external lighting requires a coordinated plan where buildings play a part in the overall picture rather than compete individually.

Exterior lighting is a recent craft and the rules are still seeking consensus among the experts. Among the more common concepts, the following are worth reconsidering:

Brighter is better: A common practice in over illuminating objects and spaces causing discomfort to the users from the glare and discord with the surrounding. It is also a waste of energy. Furthermore, lighting everything brightly would not create emphasis on key elements and the viewer would not know what to focus on.

More color the better: While this may be true for festivals and seasonal decorations, it cannot be applied to architectural and spatial lighting for the city. A more cohesive image is desired with a play on contrast and hues.

Decorative preference: Lighting should first achieve the functional tasks and not be obtrusive. During the day, if not concealed, the light fixture design should also be visually congruous with the surroundings.

NIGHT LIGHTING OF THE CITY

On an urban scale, the legibility of various elements like buildings, streets and open spaces need to combine to give overall legibility to the city. It is the appreciation of key urban streets in a hierarchy of the city's monuments, buildings and major routes that the night lighting has to achieve in order for that "legibility" to be attained.



Les Halles_Light Cibles



Albukhary Foundation_Light Cibles_2006



Esplanade Theater_Singapore_Light Cibles_2002



Pont Feng Hua_Light Cibles_2007



Ningbo holiday_Light Cibles

1.1. Benefits of Urban Lighting

The intention of this guide is therefore to evaluate the **visual requirements** of each of the road users and make **recommendations for their safe and easy progress along roads and paths in urban areas**. In addition, as one of the main purposes of urban lighting is the improvement of the night-time appearance and character of the area, recommendations are given on how such effects can be aimed at and how lighting equipment should be aesthetically incorporated into the total visual scene.

BENEFITS OF URBAN LIGHTING

- **Reduce accidents:** Provision of lighting on motor ways and arterial routes to recognized standards will reduce the number and severity of accidents at night. Accidents in residential areas are also significant. Many of these occur at entrances to railway stations and at bus stops. Also near schools and recreation centres as well as in purely residential streets where children play either on sidewalks or in the street itself.
- **Reduce crime:** The improvement of the lighting performance can directly reduce the number of acts of crime and harassment. Fear of crime, which can be as harmful as crime itself is reduced by good lighting. In this case, facial recognition should be taken into account.
- **Added quality to the night life:** Lighting at night in the streets and other public areas can contribute considerably to the character and vitality of a city. This can generate a sense of civic pride and provide a draw card for tourists. The provision of lighting in an urban area will also be of assistance to visitors to the town or strangers in a particular area. It provides proper orientation within the area

and allows quick and accurate identification of streets and houses. With lighting we can help people enjoy their night-time experiences, giving a calm and pleasant lighting. Allows the city show its architectural essence, volume, texture and color, giving a clear view of their hierarchy in the master plan. Good lighting will always assist the services of ambulances, fire fighting crews, police cars and rescue teams in an emergency. The different zones in the master plan, will also be taken into account when choosing the lighting material. Different models will be presented with the design intended for each area, including aesthetic and culture icons.

All these lighting benefits are summarized in the following points

- **Reduce accidents.**
- **Reduce crime.**
- **Added quality to the night life:**
 - *Generate tourist attraction.*
 - *Orientation within the site.*
 - *Assist basic services.*
 - *Establish a building illumination strategy.*
 - *Establish a luminaire palette to communicate site aesthetic.*
 - *Stimulate evening socializing.*



Nanjing West Road_China_2009



Lighting Beirut Architecture_Lebanon_2011



Skyline Singapore.

1.2. Project overview and objective

PROJECT OVERVIEW

LREDC seeks to establish the Lusail Development Project as a distinctive 21ST Century City in the Gulf Region, which will become a destination of choice for visitors, residents and businesses. This Vision will see Lusail Development as a local, regional and international exemplar, which celebrates the special cultural and natural qualities of Qatar and the Gulf Region.

Therefore LREDC wishes to hire a qualified, highly competent “Lighting Consultant” (“the CONSULTANT”) to prepare a Nightscape Master Plan. The Nightscape Master plan shall address development of a lighting strategy for all external lighting in Lusail Development. The major components of this will include:

1. Development of a strategy and concepts for the public realm including streetscapes, parks, open space, plazas, waterfront and wadi.
2. Lighting Design Guidelines for the external lighting of buildings and other structures and for lighting of privately-owned external areas.

OBJECTIVE

Lusail Real Estate Development Company (“LREDC”) is seeking to create a distinctive public realm of its civic plazas, open spaces and streetscapes, with a special sense of place that celebrates the diversity of the Lusail development and the rich cultural heritage of the country and the region. The development of a comprehensive external lighting strategy (The Nightscape Masterplan) is viewed as an essential part of the public realm and its successful implementation will lead to extend enjoyment and an enhanced variety of experiences for the residents and visitors of Lusail Development.

The principles which will guide the design are as follows:

- Reinforce the vision of Lusail Development as an exciting and vibrant twenty four (24) hr destination.
- The lighting strategy and design should aid in creation of a unique identity and reinforce the key physical components of the city.
- Enhance and extend the opportunity for enjoyment of external spaces into the night-time.
- Utilize lighting design to distinguish key elements & district characters within Lusail Development.
- Lighting shall be used to maximize the safety and security of all residents and visitors.
- Adherence to sustainable design principles with particular emphasis on minimizing energy consumption.

- Minimize light pollution and unnecessary light spill including the use of lighting in advertising and billboards.

- Integration of the lighting design with the concepts for the public realm and consideration shall be given to public art and built elements within this.

- Incorporation of state of the art technology and contemporary design befitting a leading 21ST century city.

- Use of highest quality materials and products.

** Client brief.*

2. HOLISTIC APPROACH

2.1. Street / Spaces Analysis

The following overall plan diagrams summarize key layers of the Master Plan which have an influence in the design of Lusail's streets.

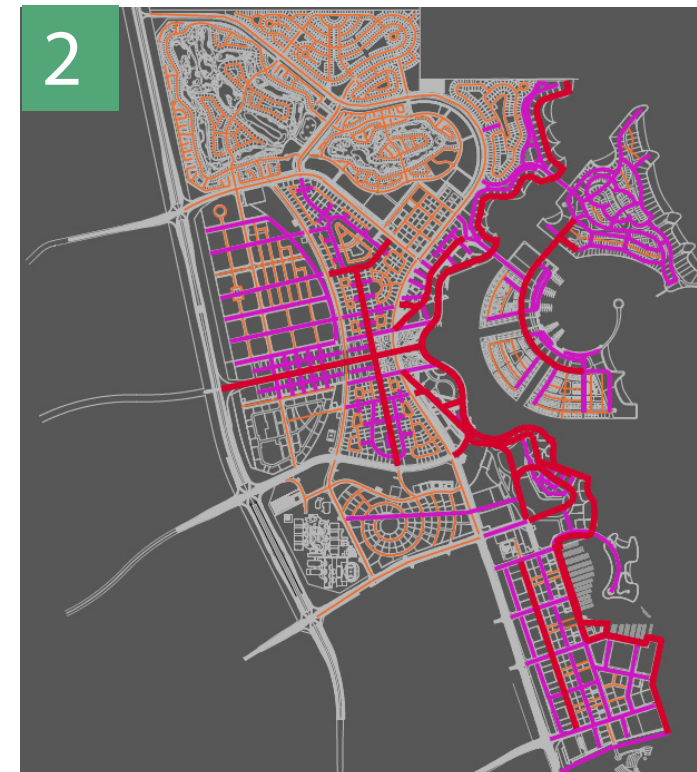
These diagrams illustrate the planned road hierarchy, public transportation, pedestrian route, cycle route, landscape, gateways and landmarks.

All this information allows us to understand Lusail's essence, organization and structure, collecting key elements for the lighting master plan.

After classifying the streets and all the elements in the city, with it's corresponding hierarchy, it was easier to determine the lighting intentions in relation to the categories previously stated.



Road Hierarchy Map



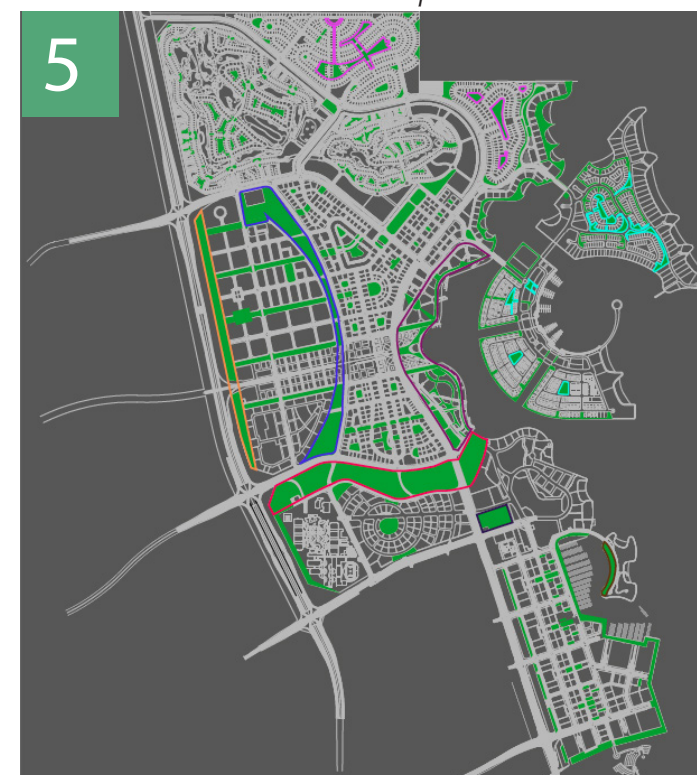
Pedestrian Route Traffic Plan Map



Cycle Route Plan Map



Gateways & Landmarks



Landscape Map



Public Transportation Map

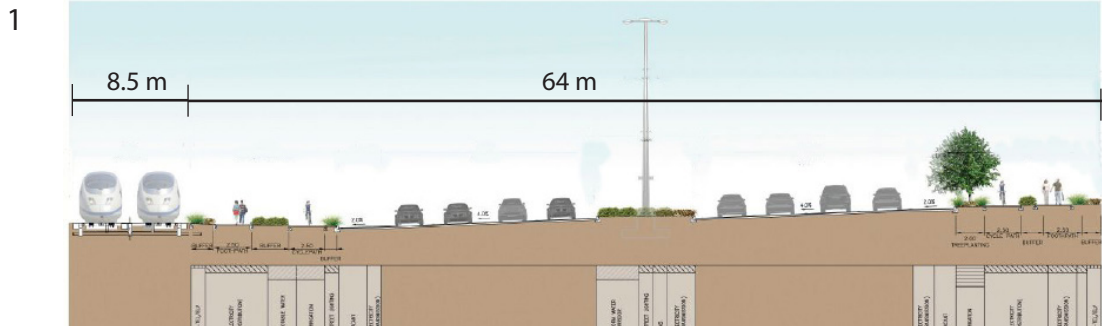
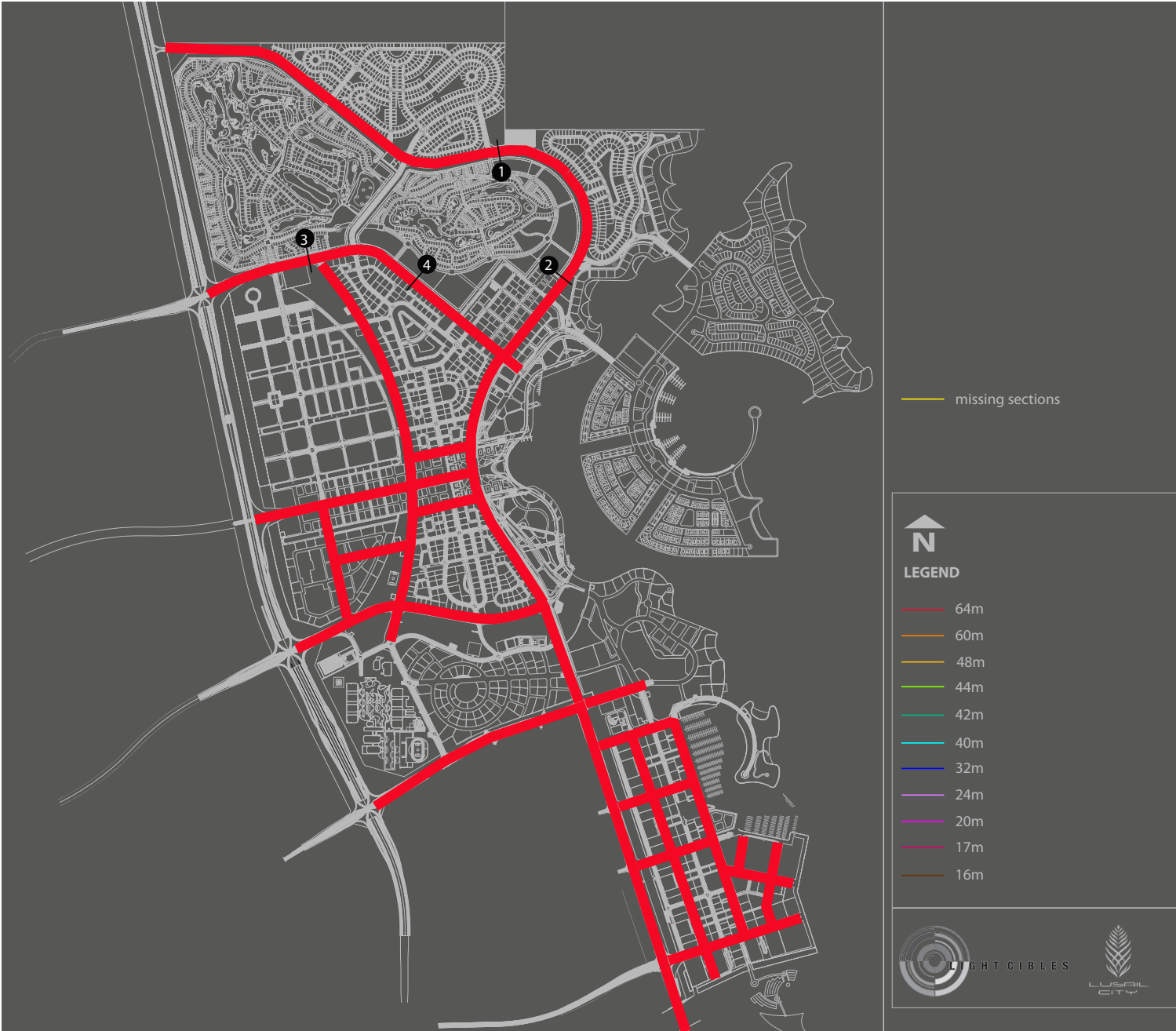
2.1.1. QHDM Sections / Lusail Sections

2.1.1.1. Lusail Right of Way
Corridors

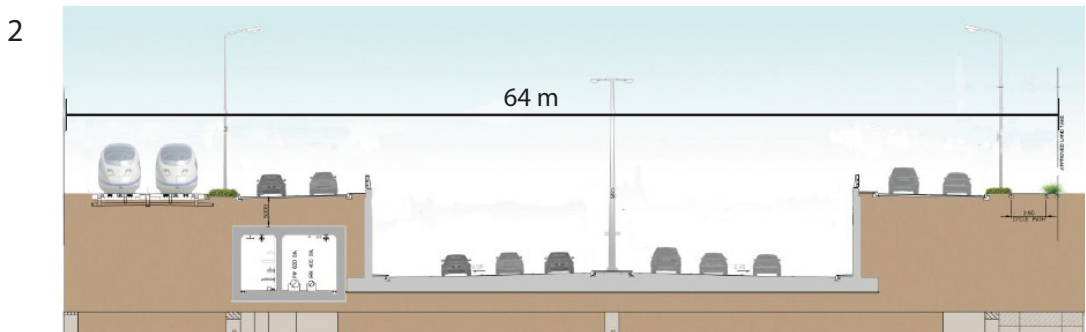


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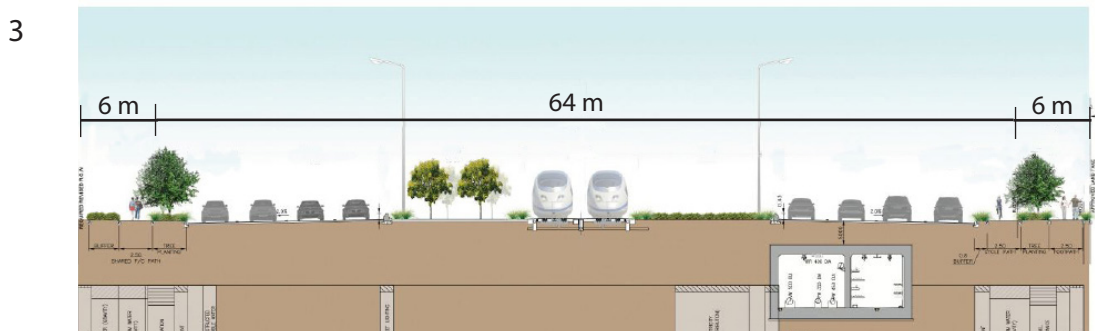
2.1.1.2.1. Sections of 64m Corridor



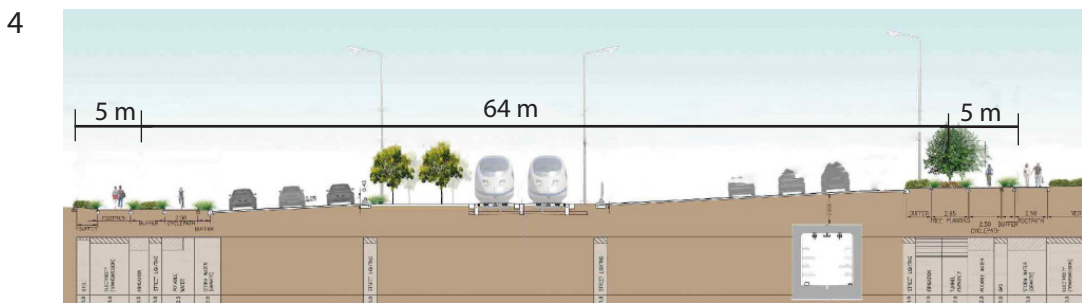
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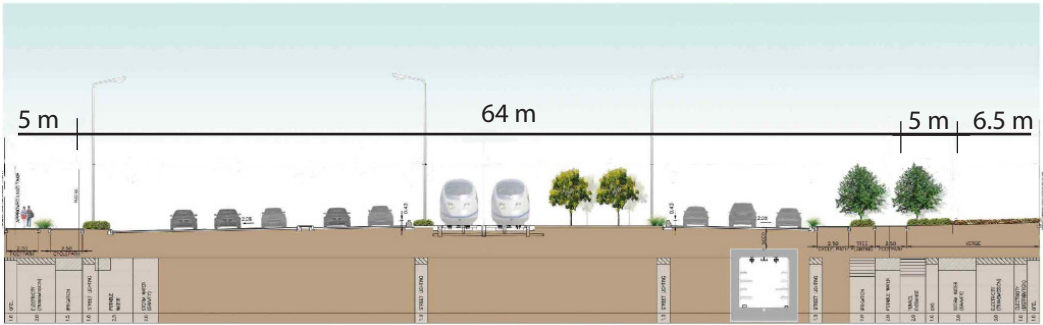
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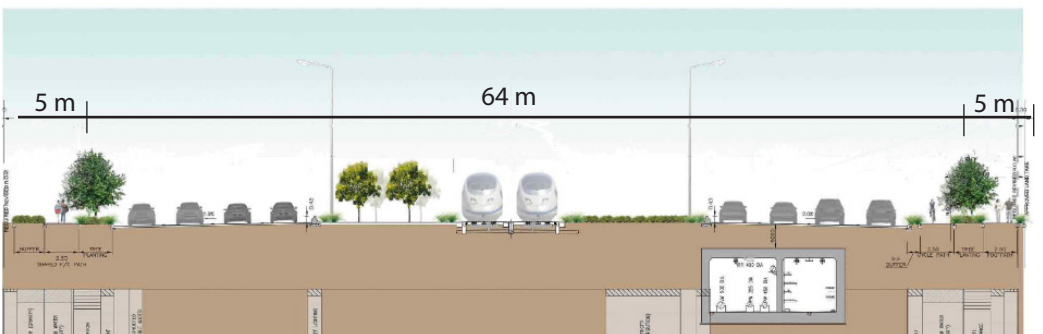


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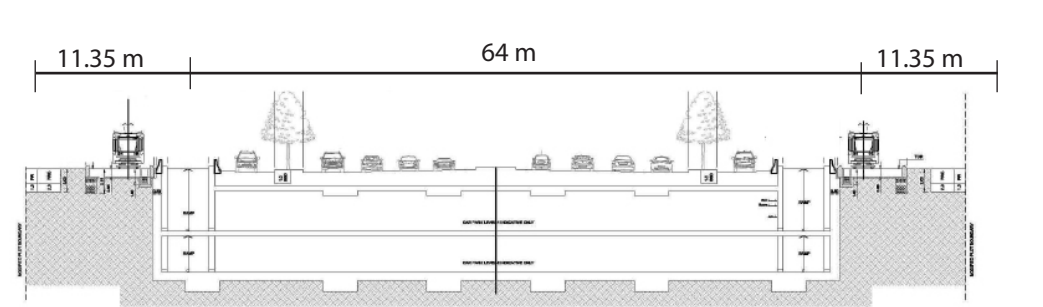
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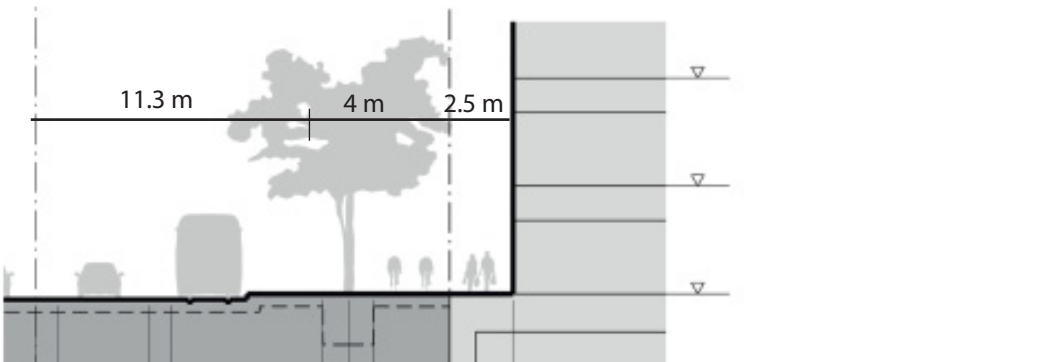
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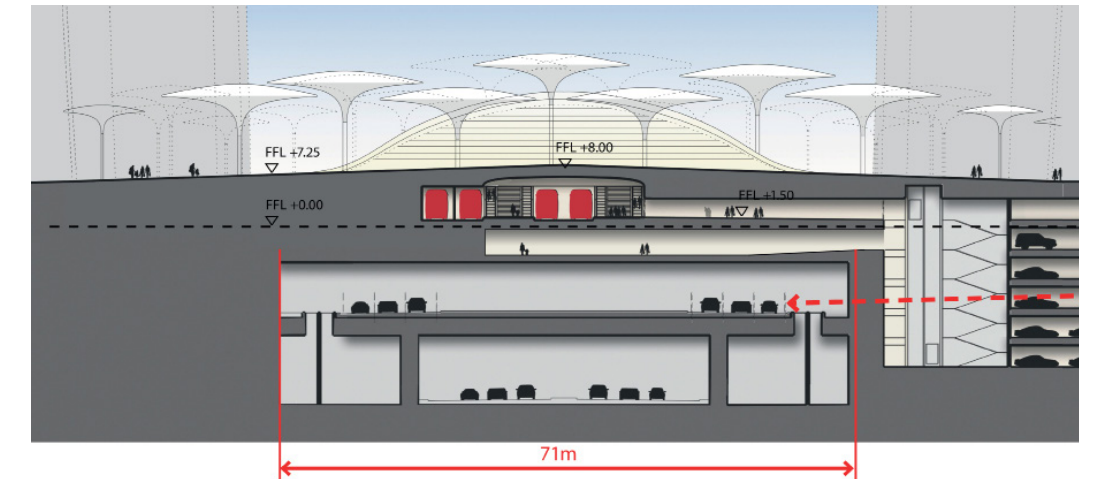
Lusail Masterplan/Masterplan updates/Comercial Boulevard

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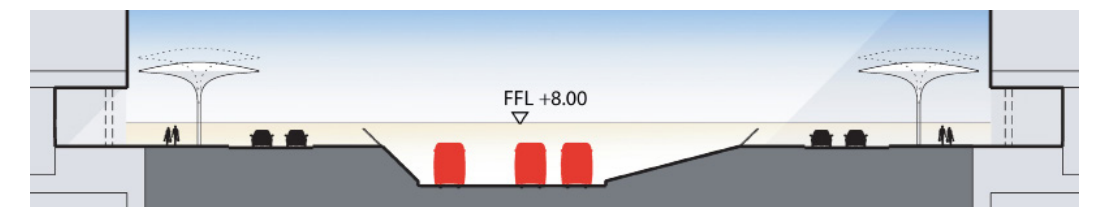
Reports/Lusail Plaza/10.28.2012

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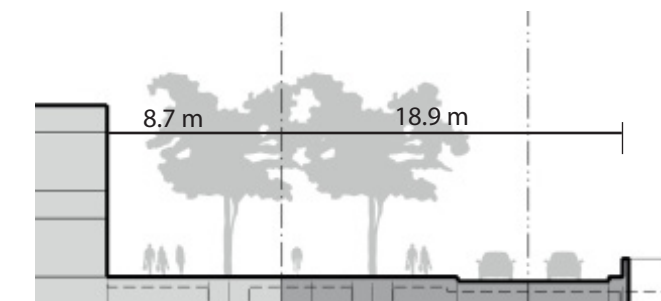
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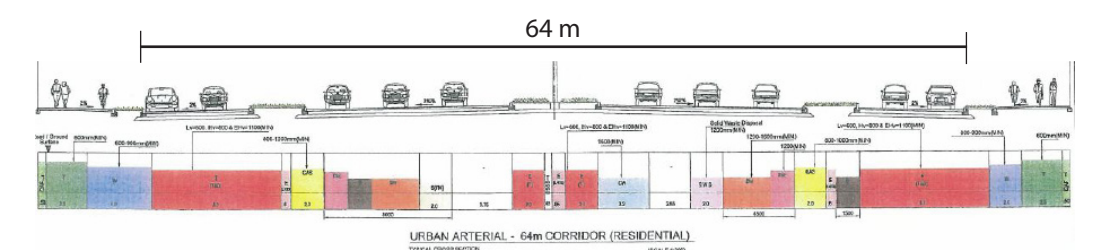
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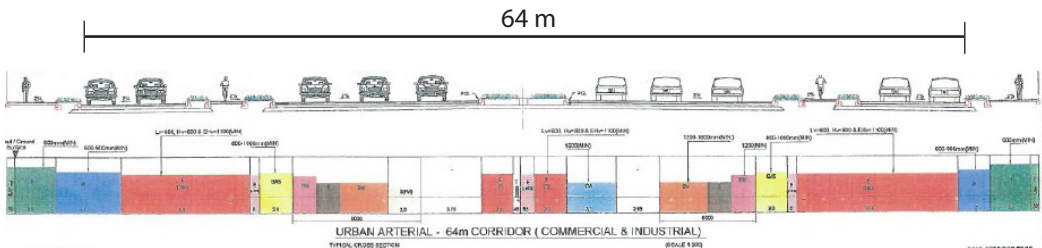


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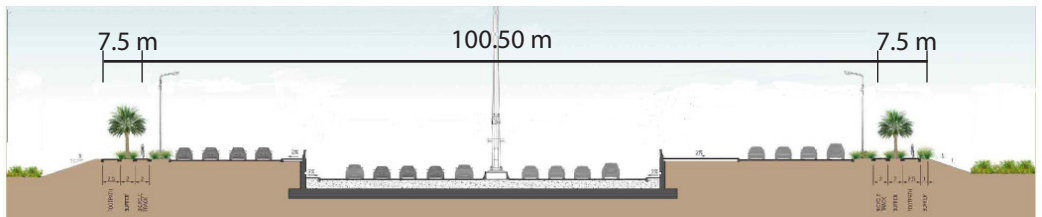


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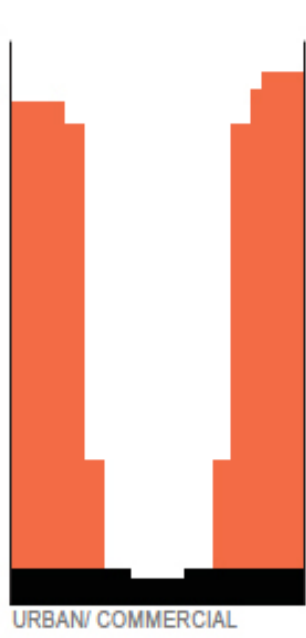
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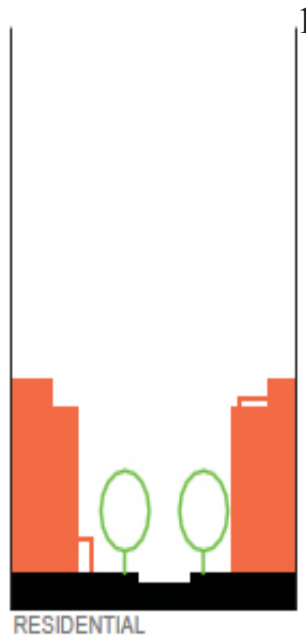


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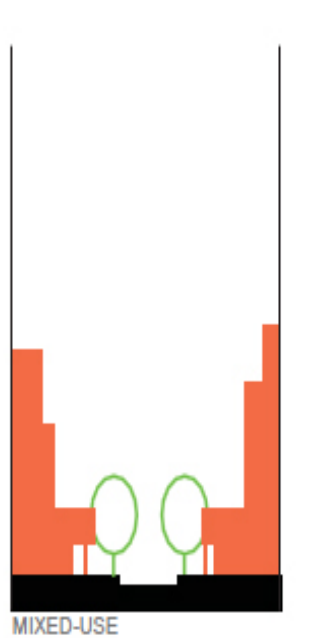
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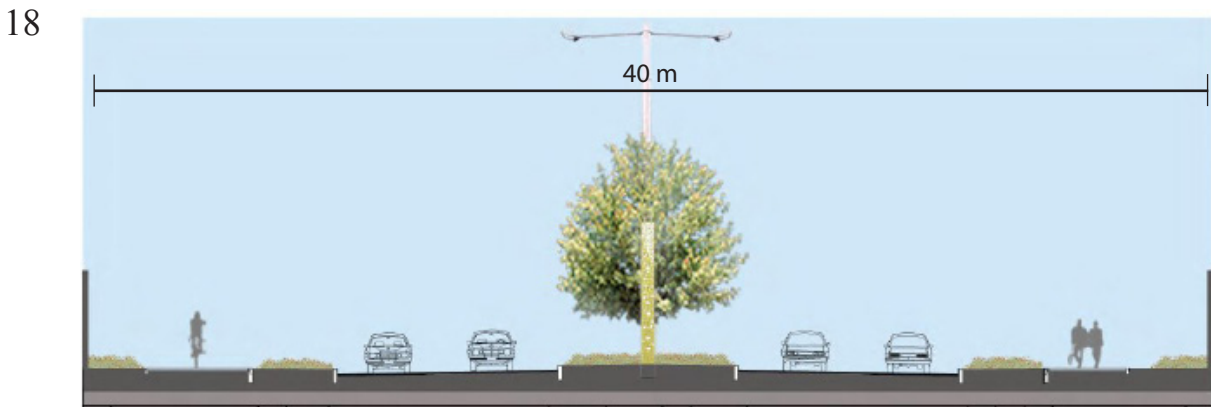
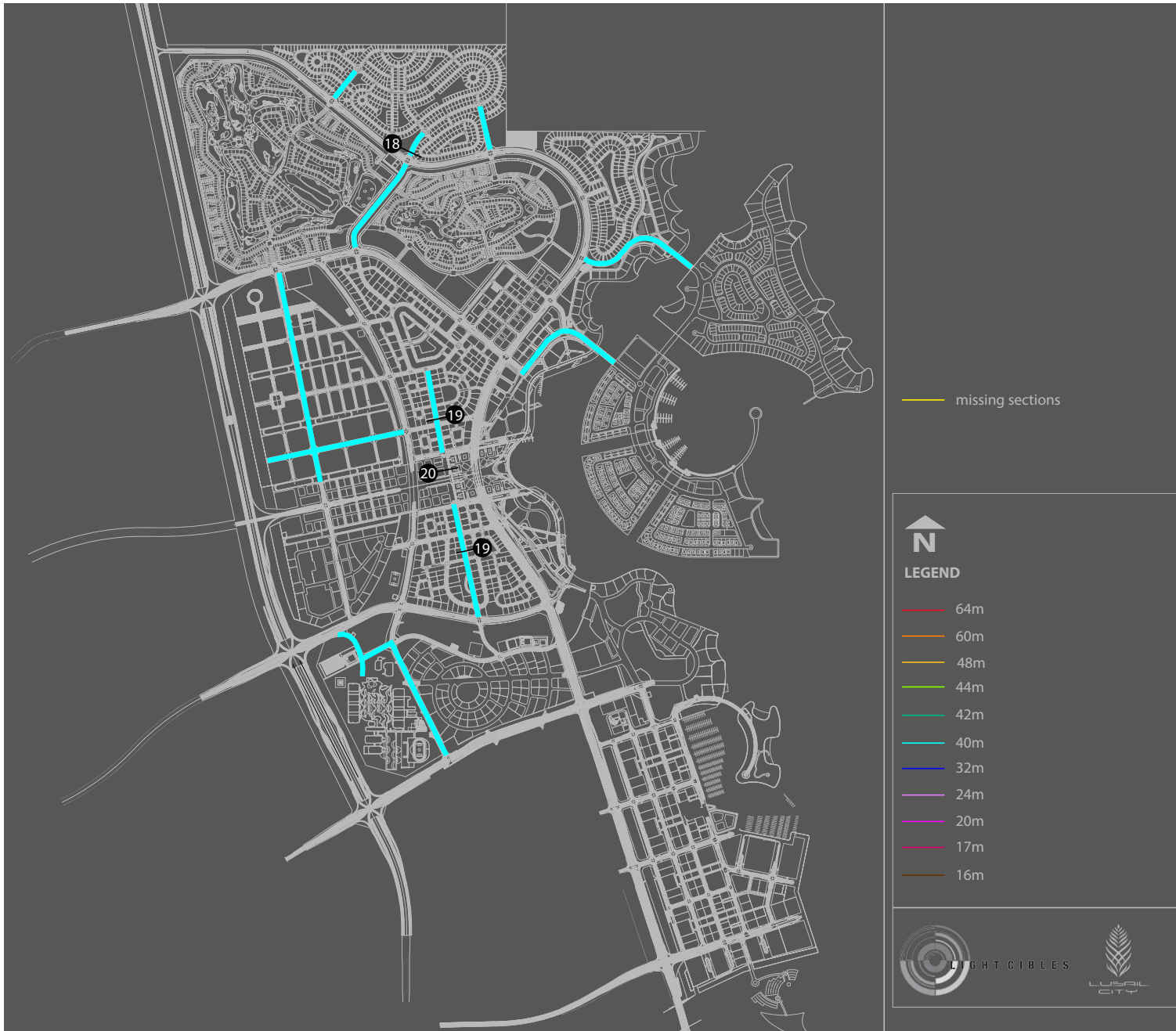


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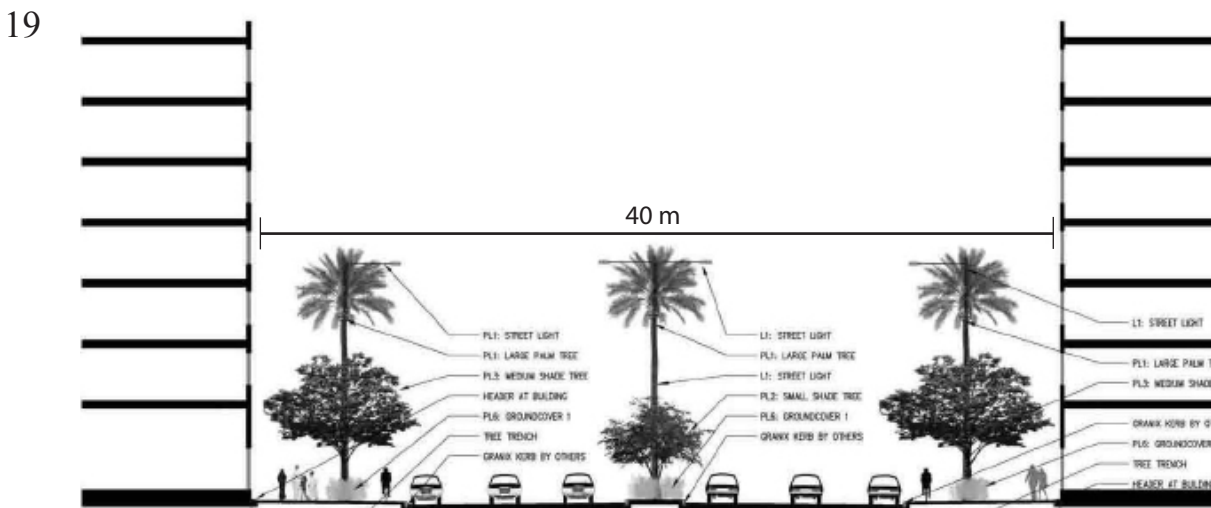


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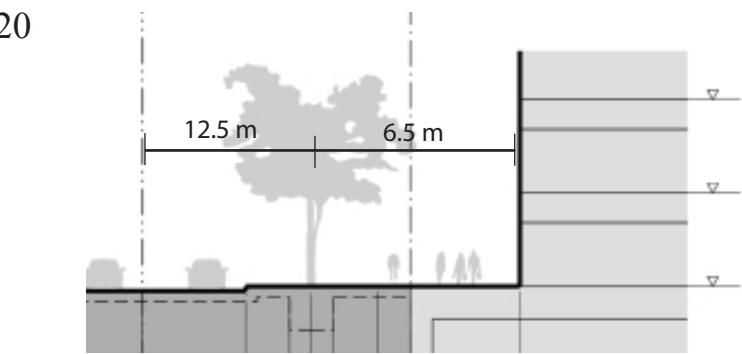
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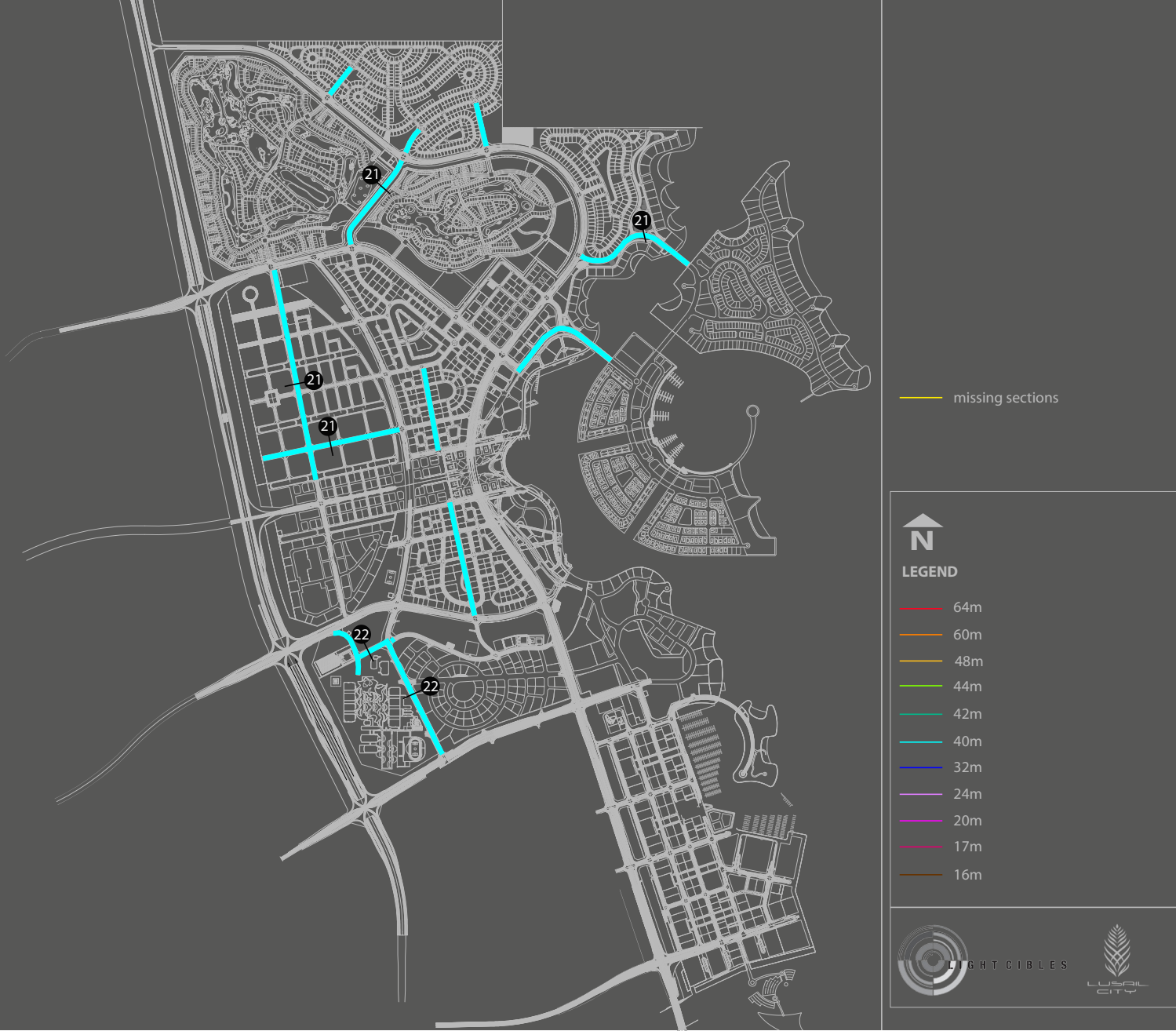
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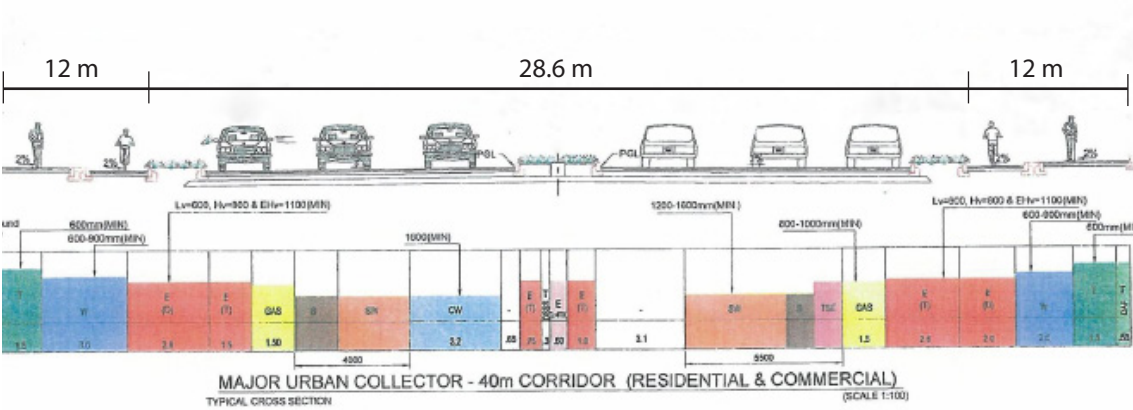
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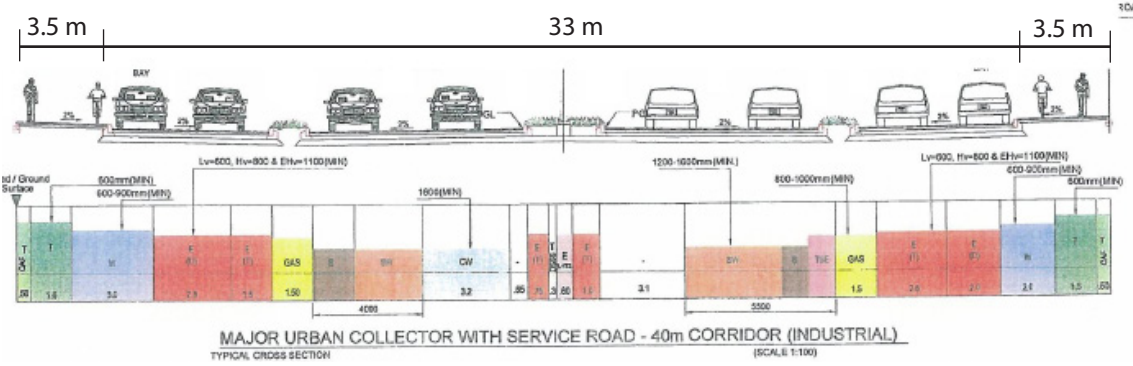


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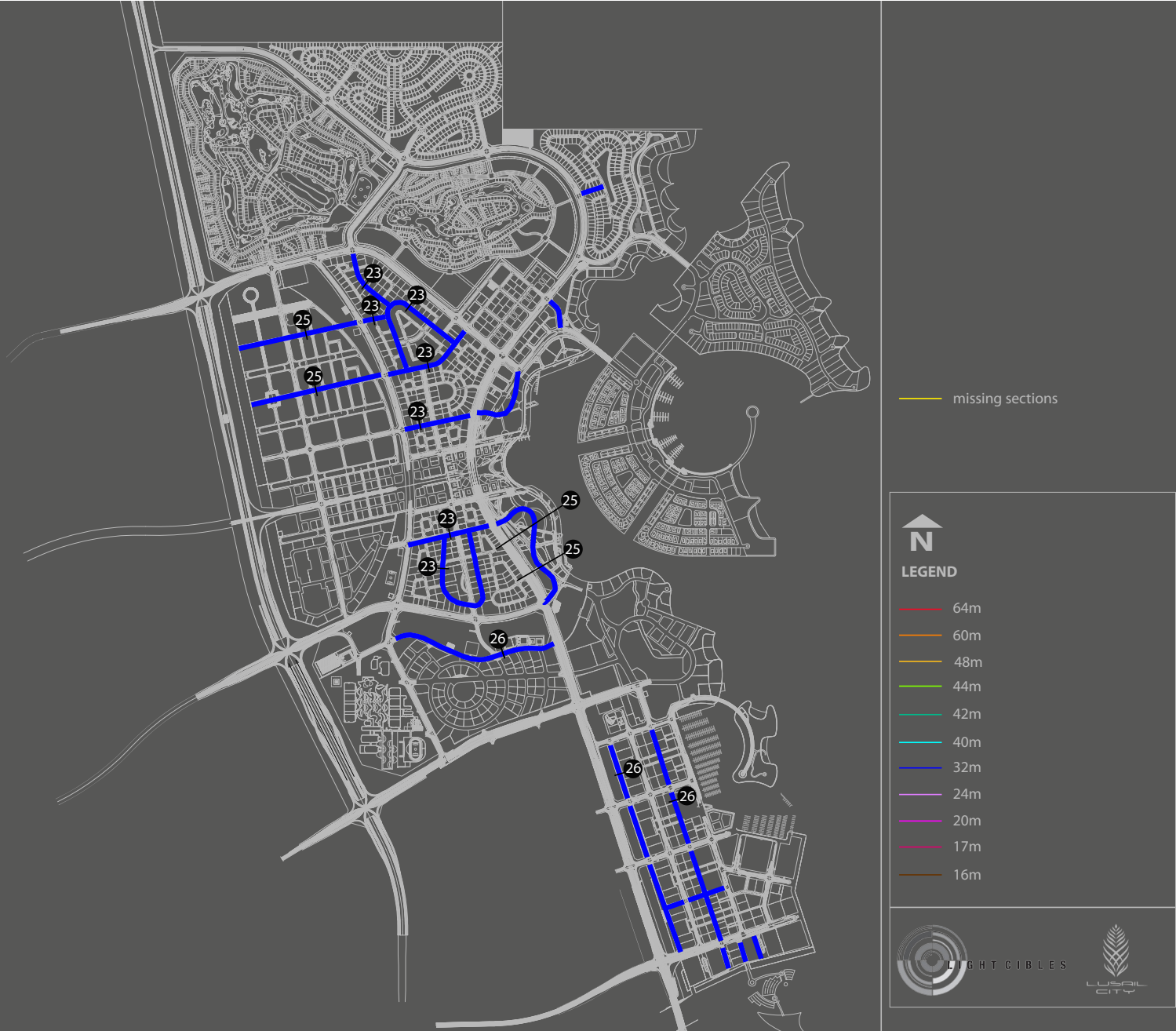
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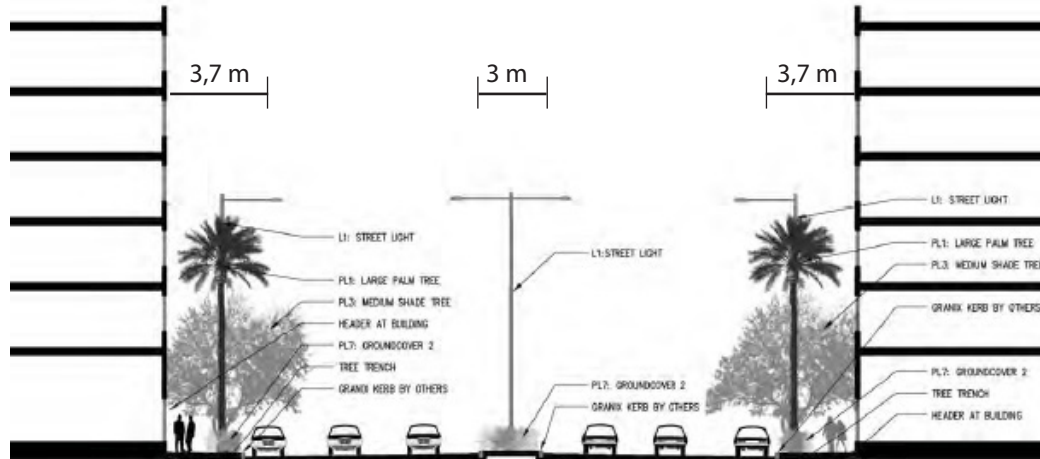


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2.1.1.2.3. Sections of 32m Corridor

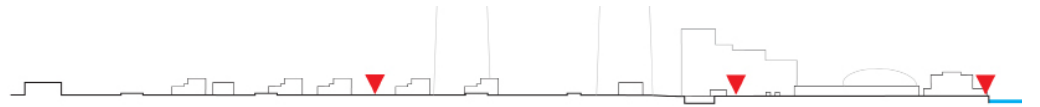


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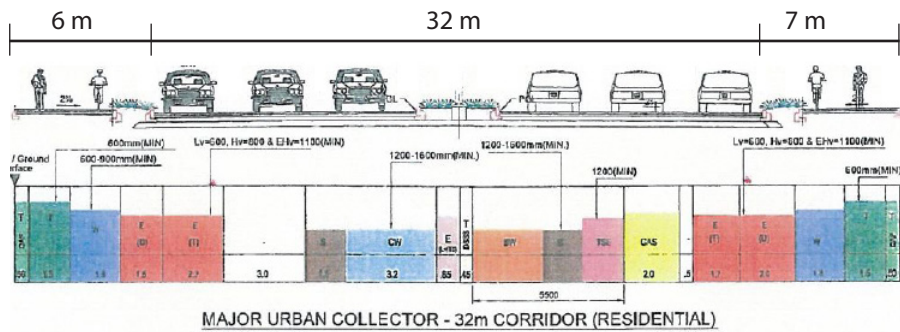
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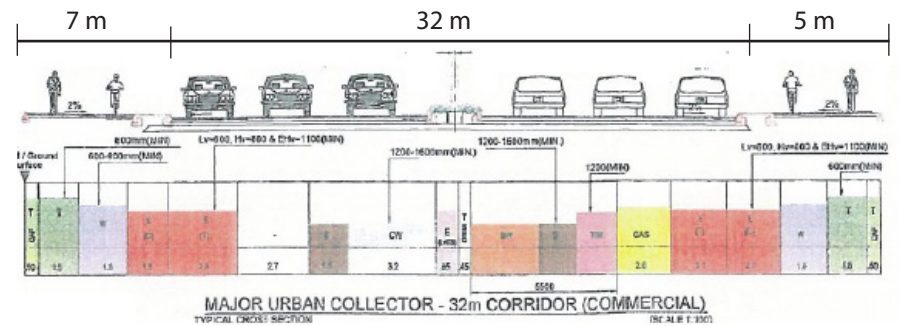
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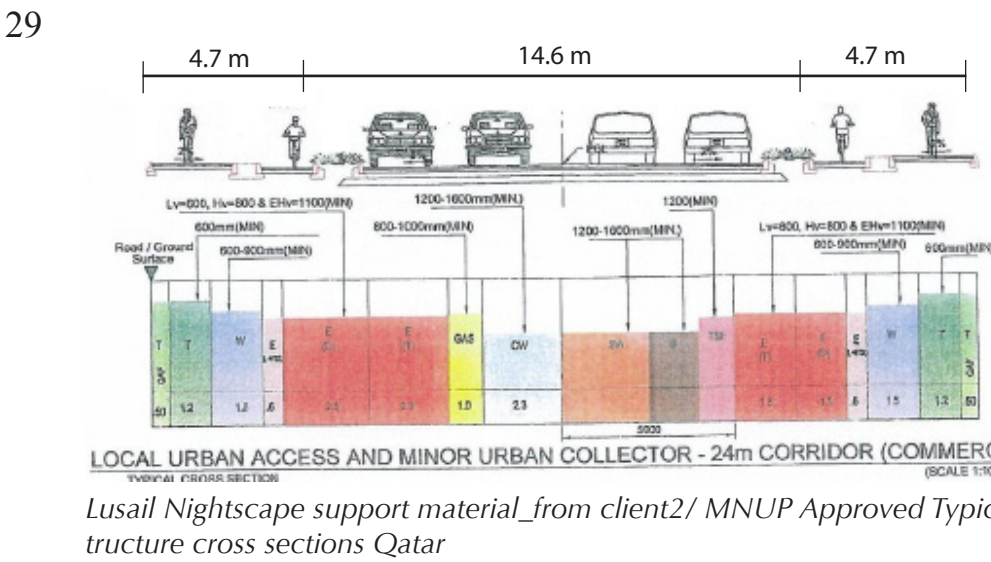
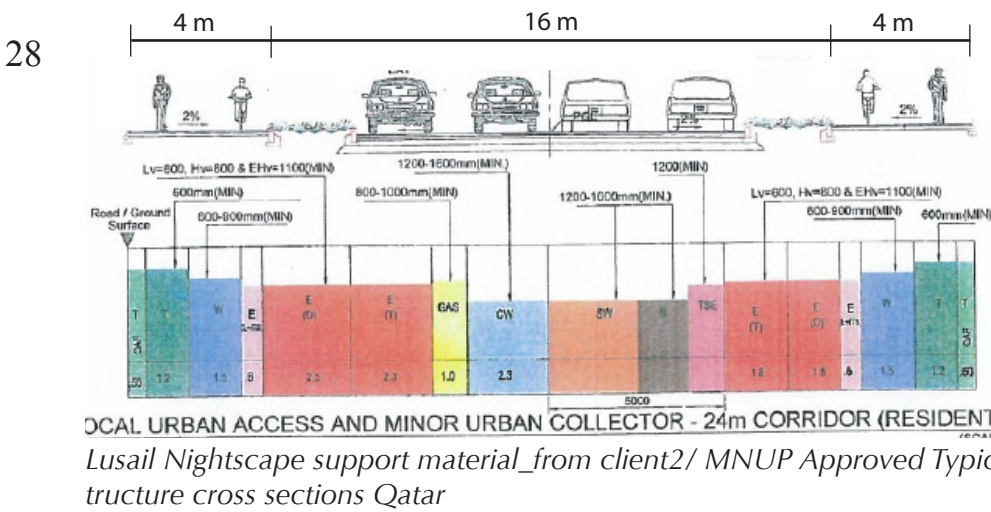
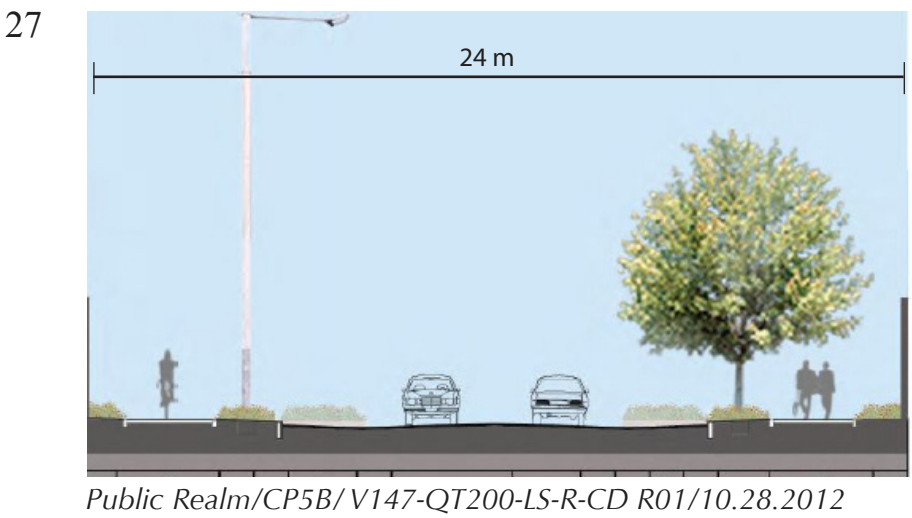
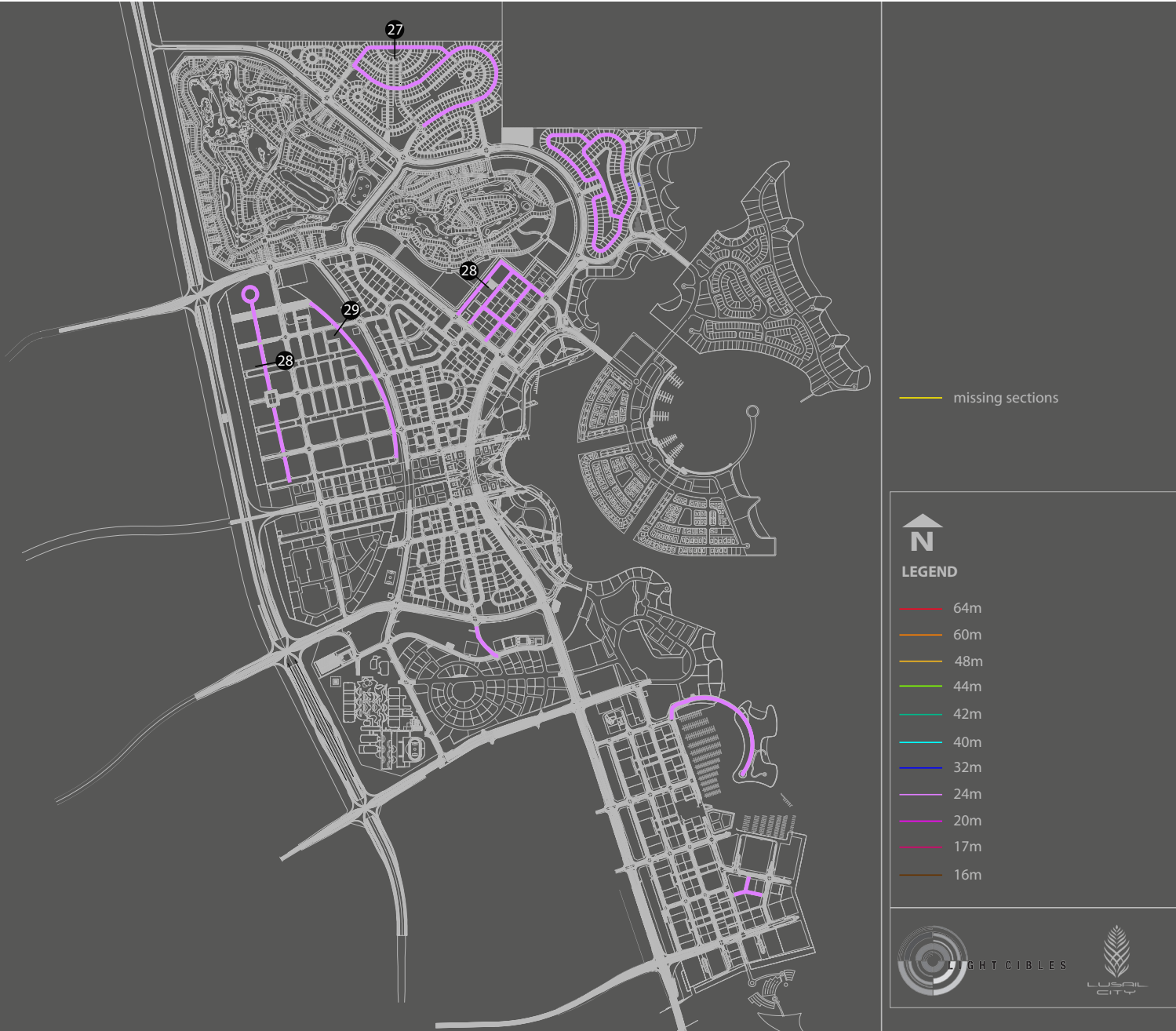
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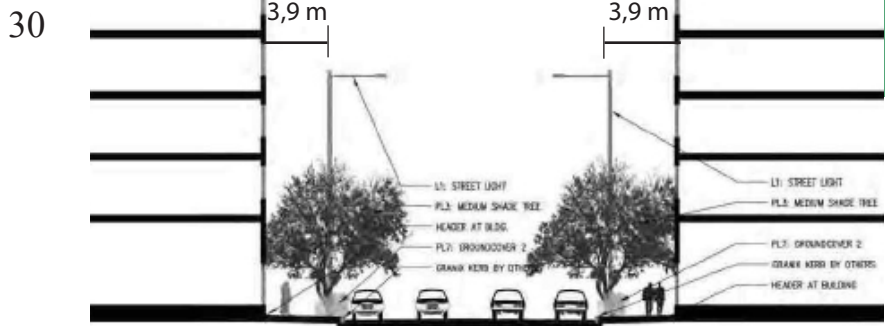


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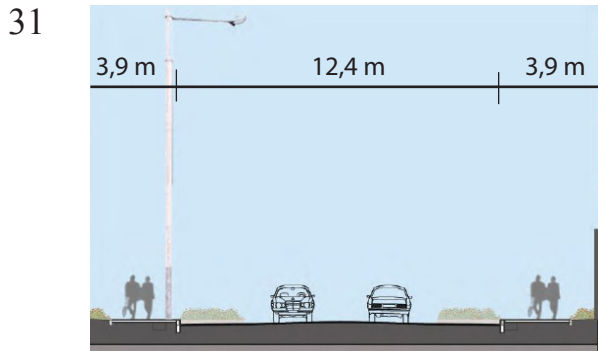
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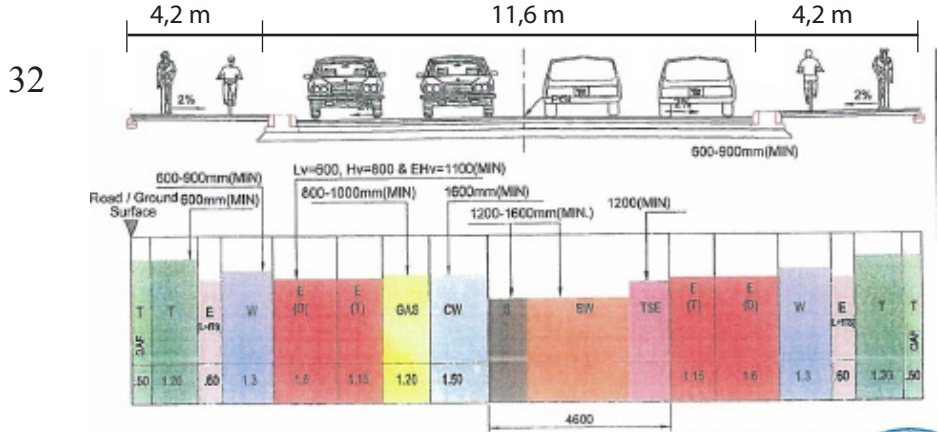
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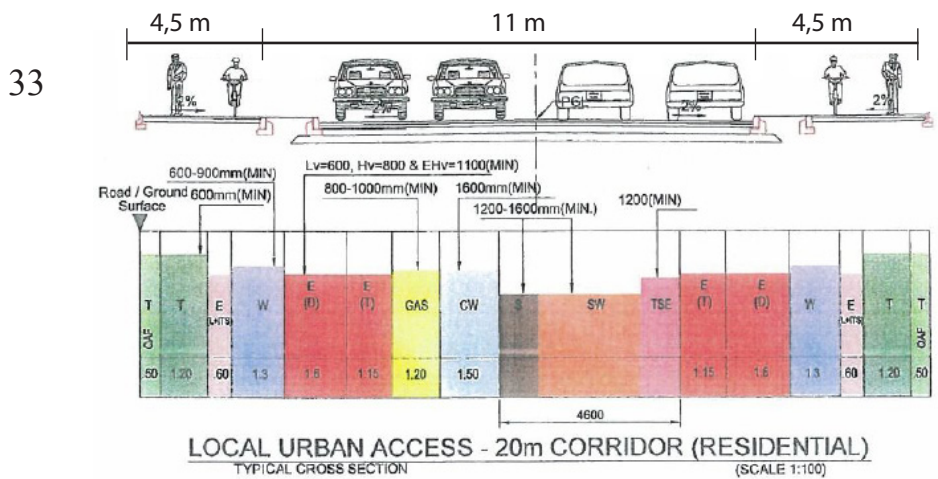
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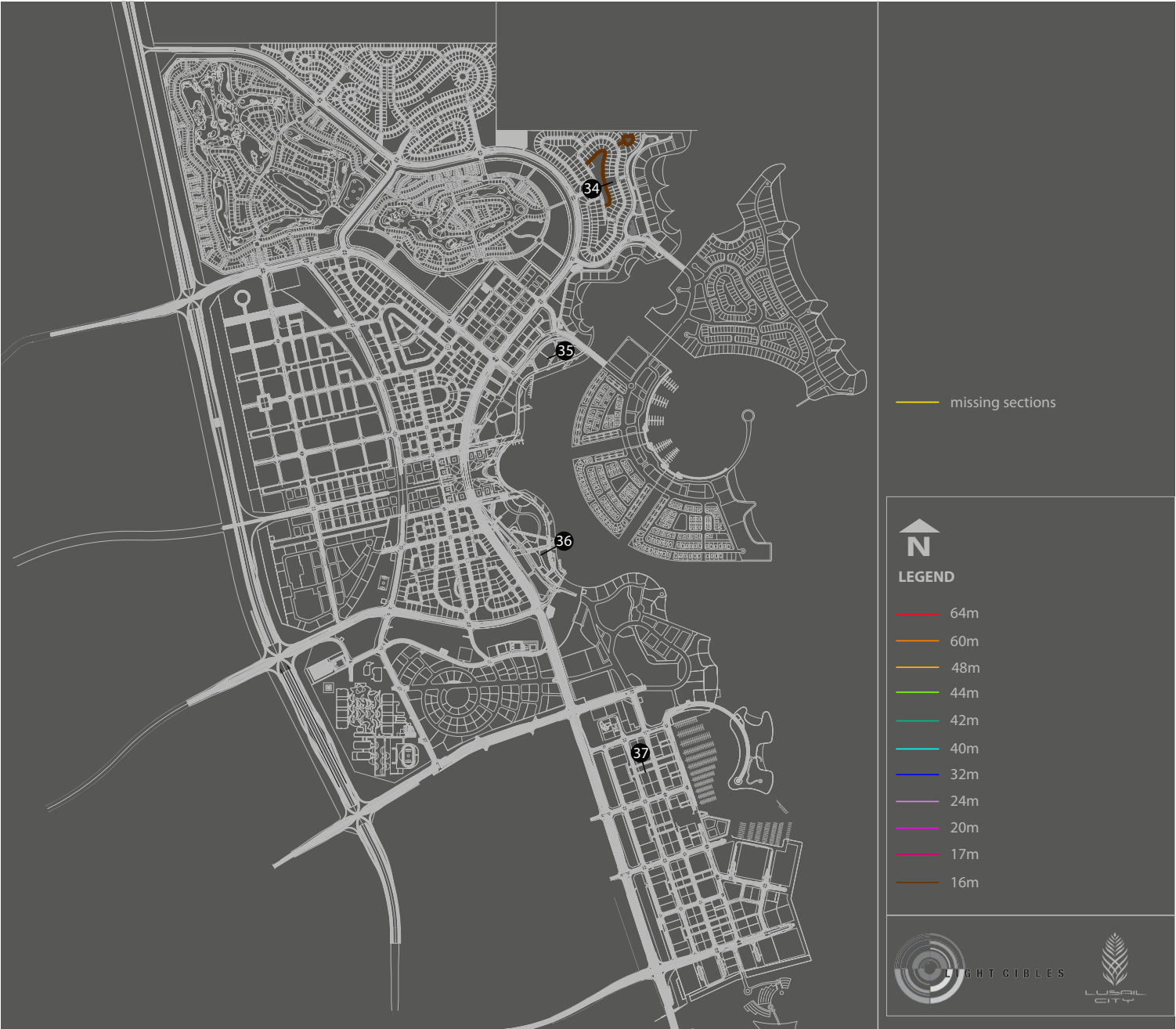


LOCAL URBAN ACCESS - 20m CORRIDOR (COMMERCIAL)
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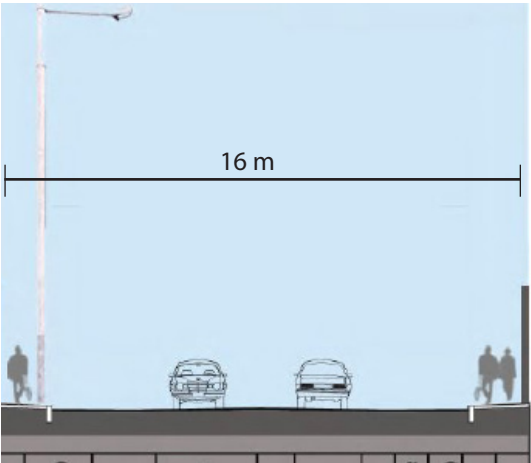


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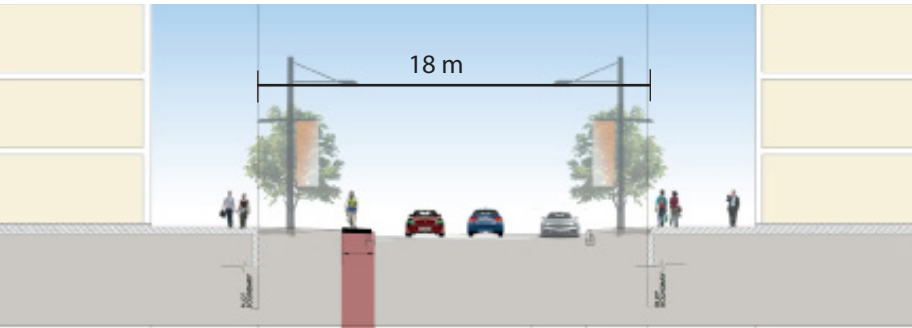


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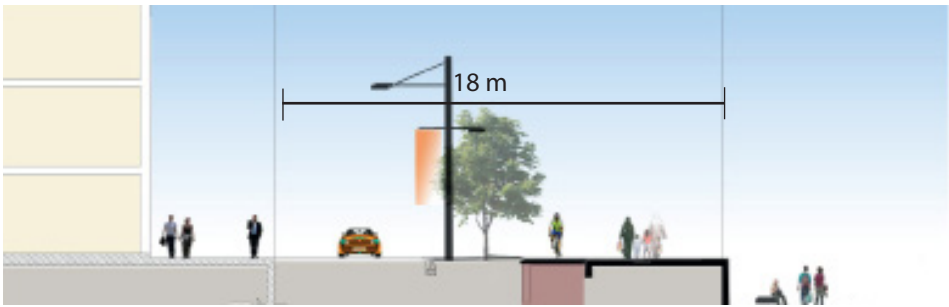
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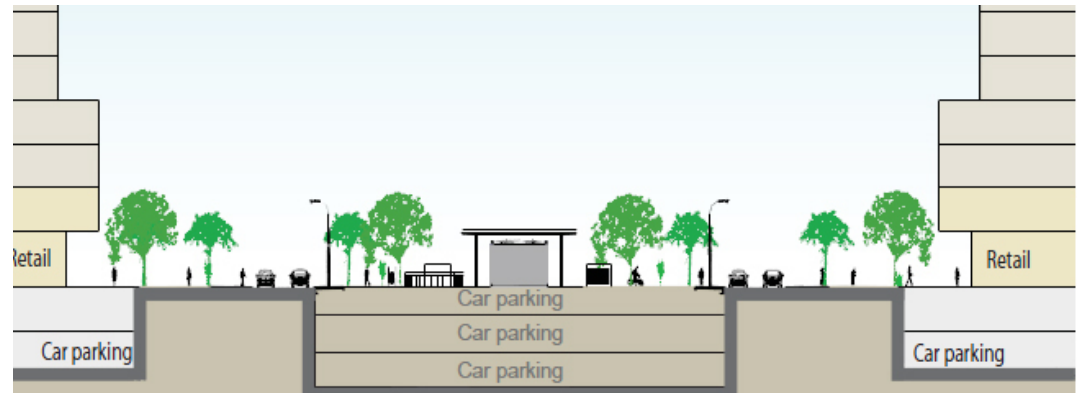
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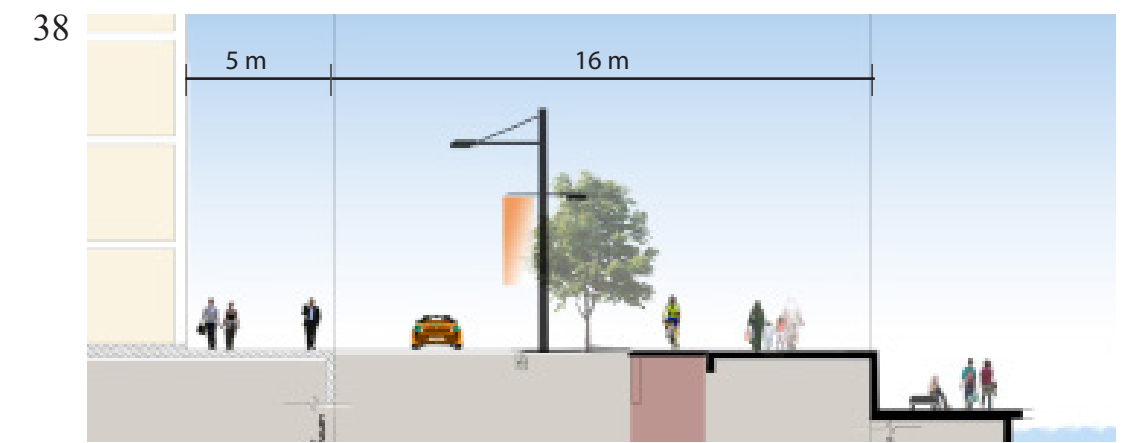
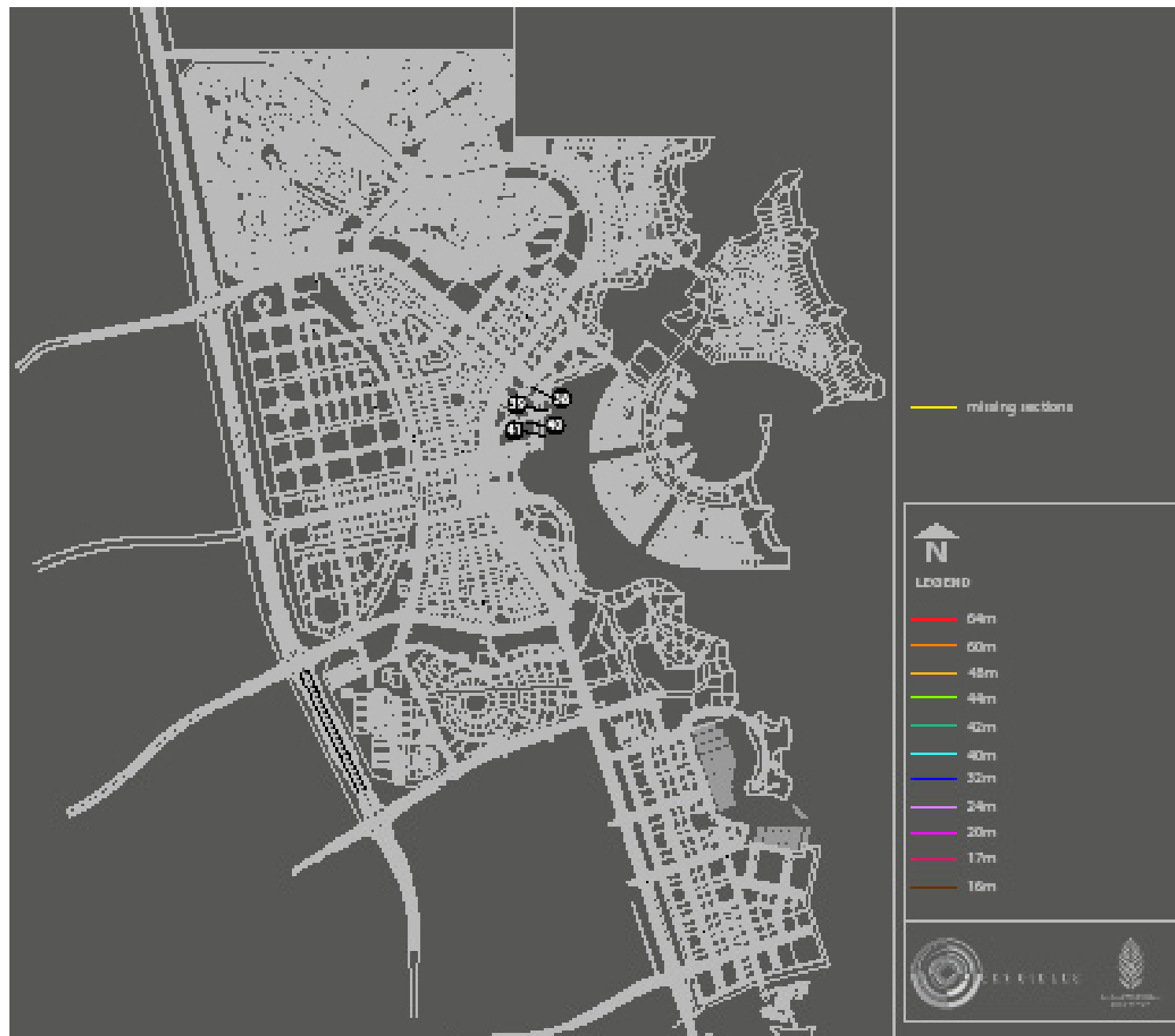
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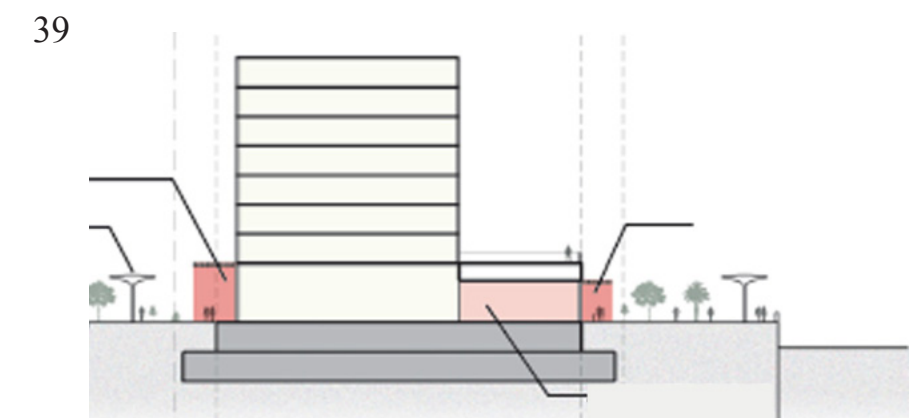


Lusail Nightscape support material_from client2/ Marina District-Urban Design Guidelines ver0-April2011

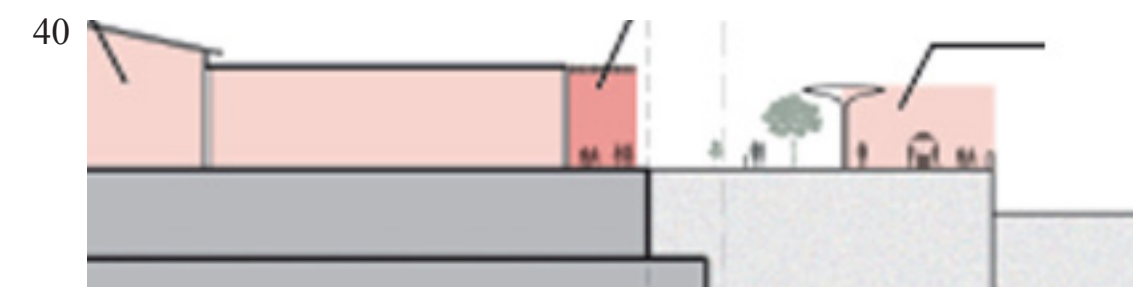
2.1.1.2.7. Promenade Sections



Reports>Seef Lusail (Waterfront Commercial)/Final Concept Masterplan 19.07. 2012/ Chapter 6 - Urban Design Guidelines



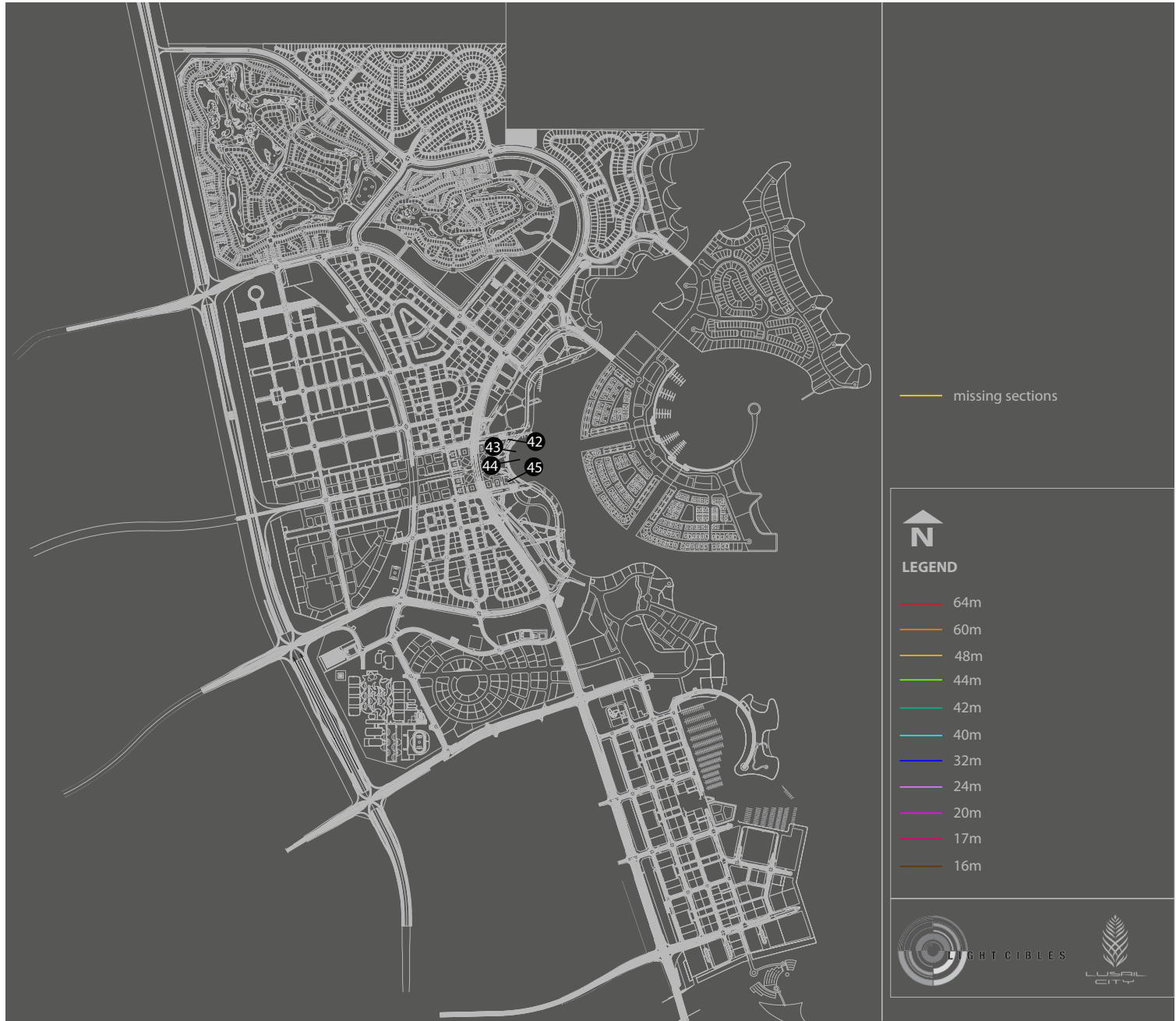
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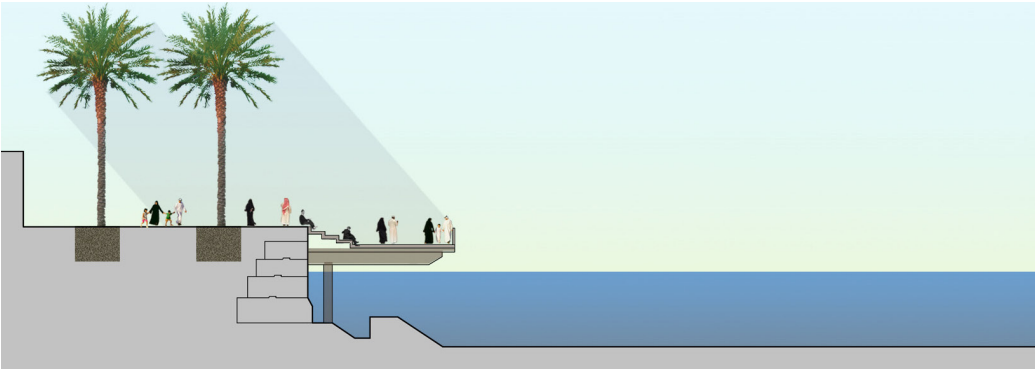
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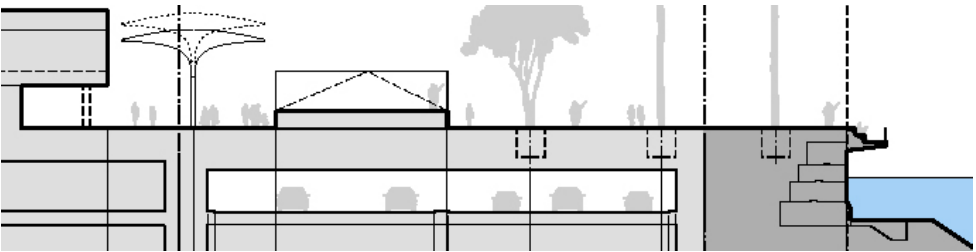
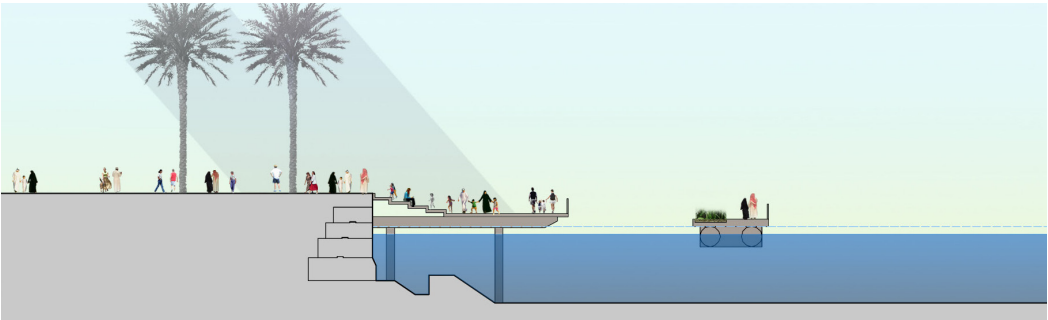


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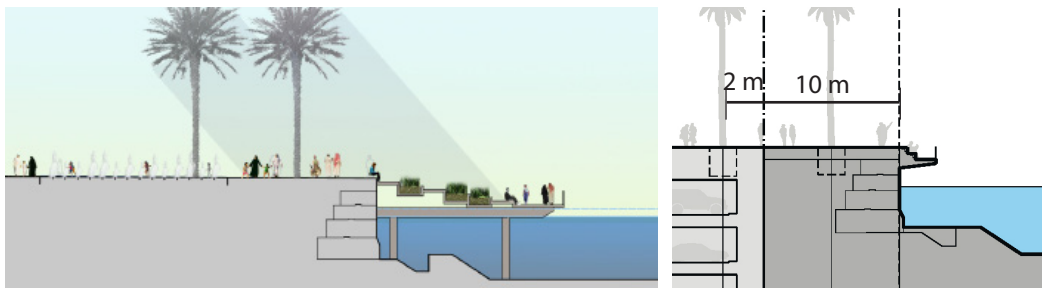
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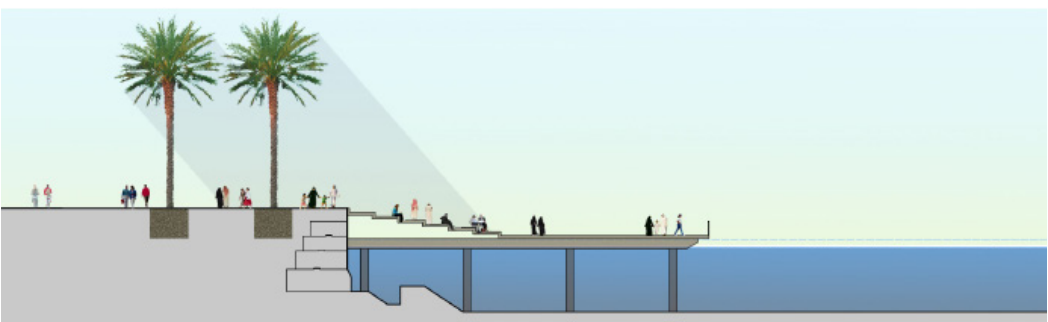
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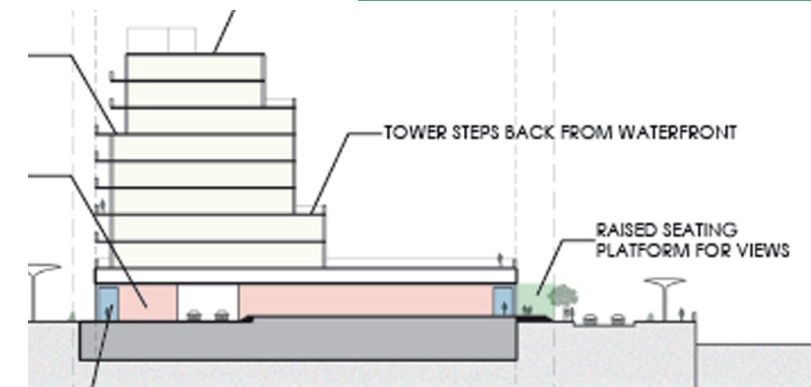
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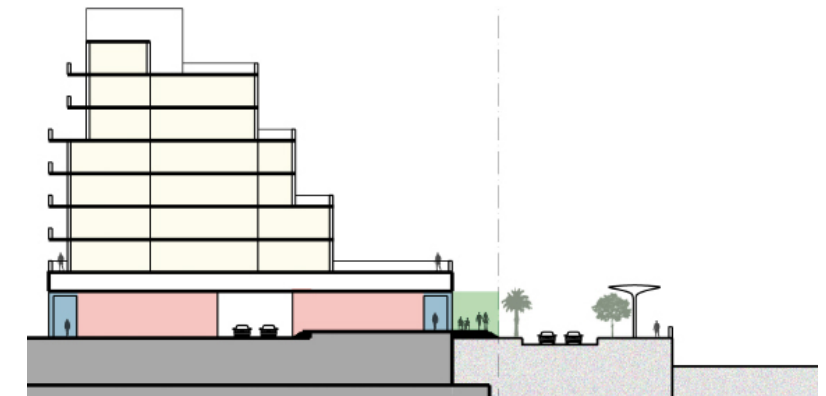
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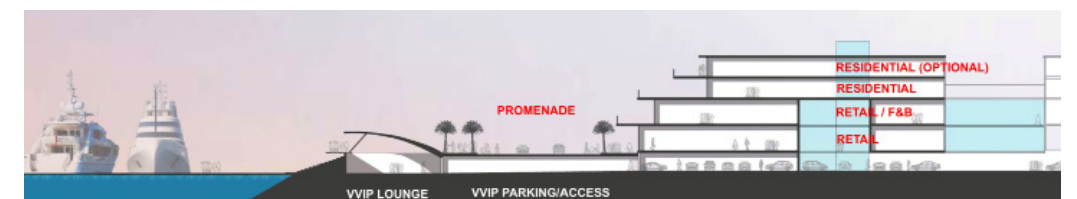
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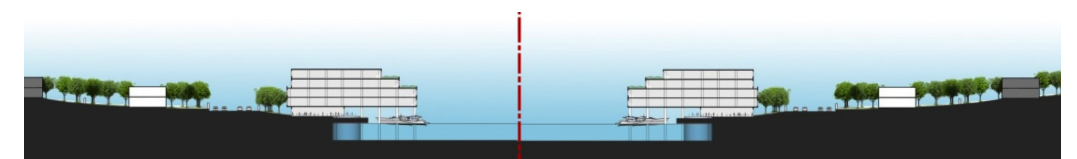
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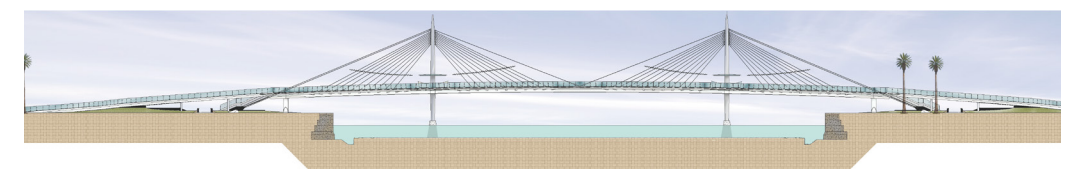
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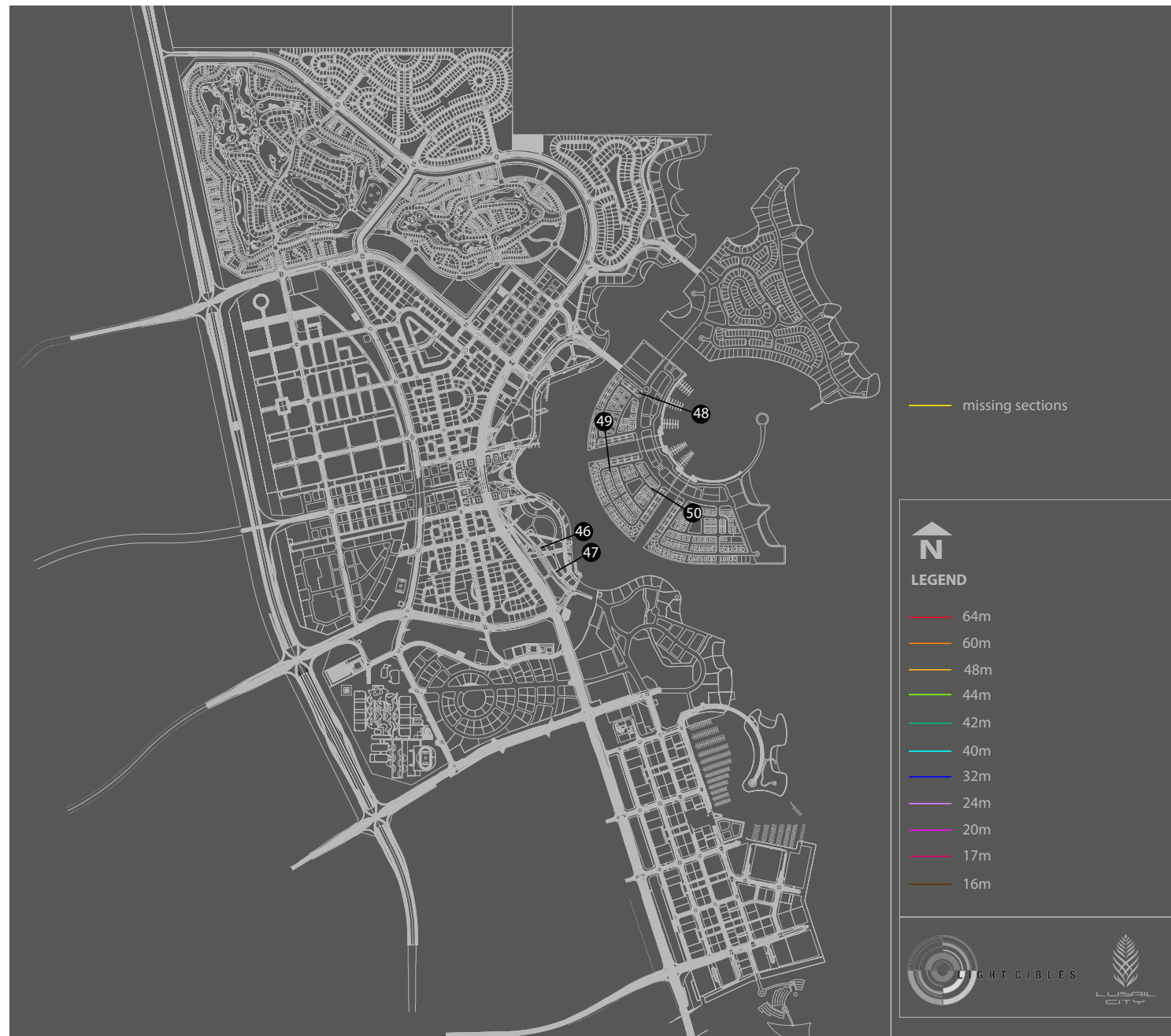


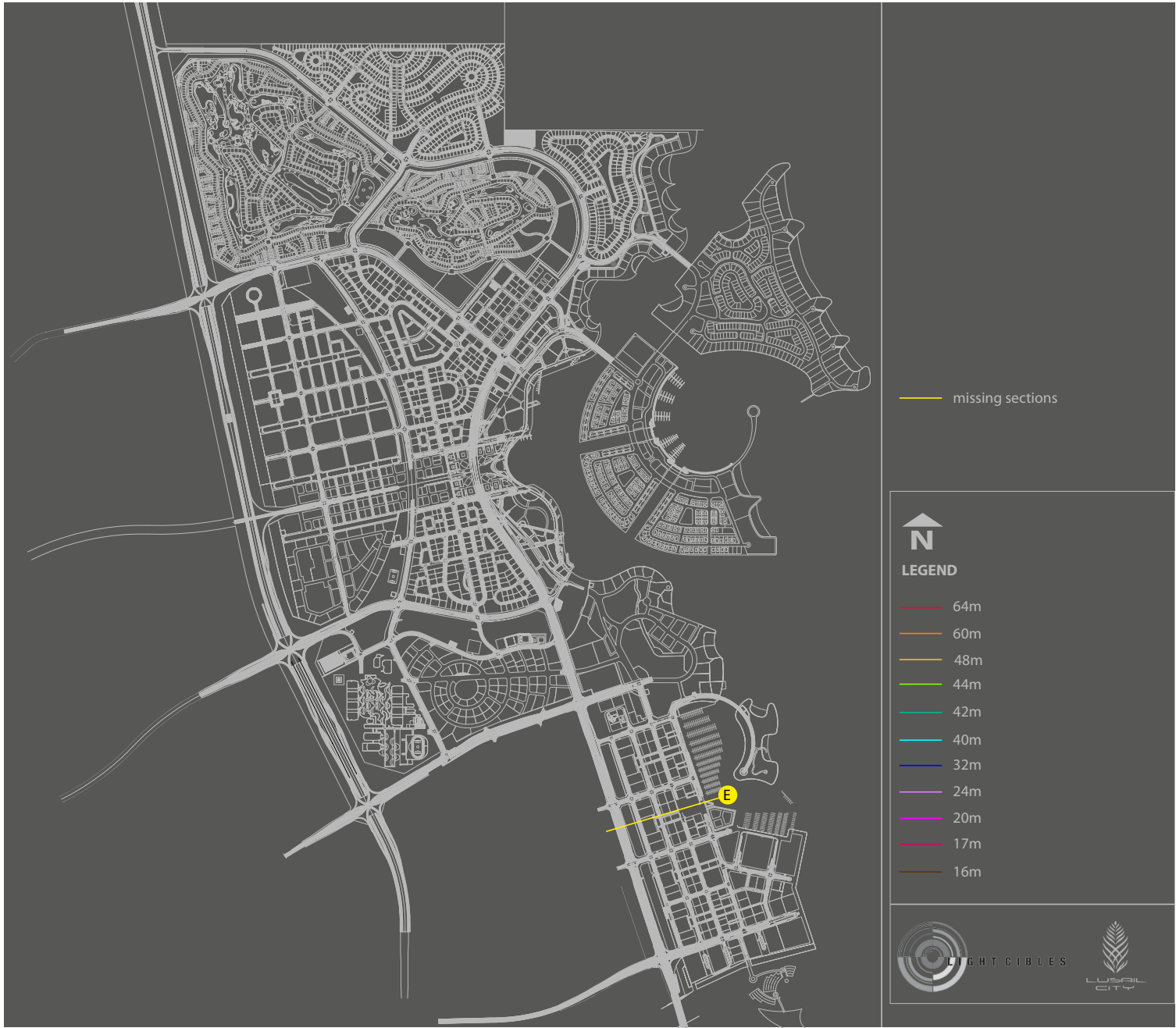
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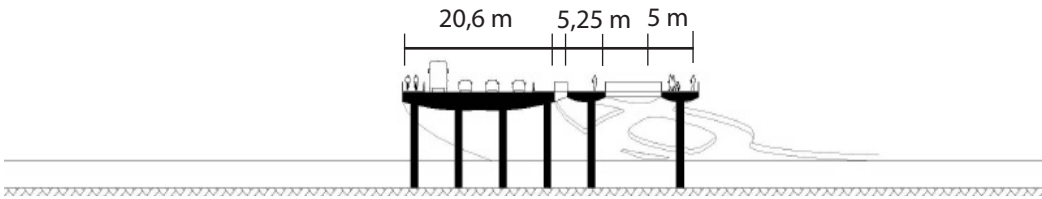


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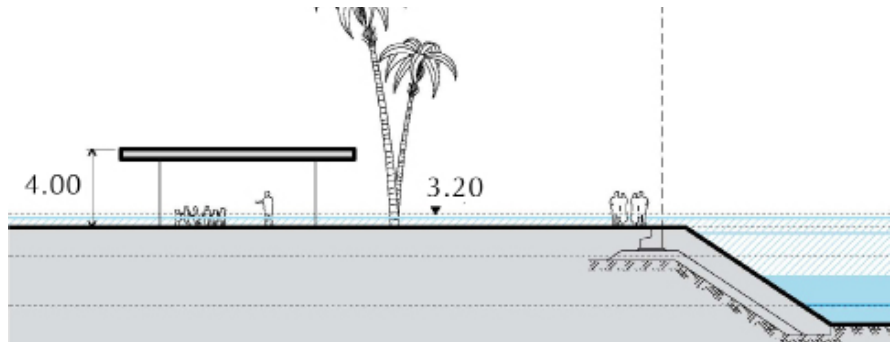
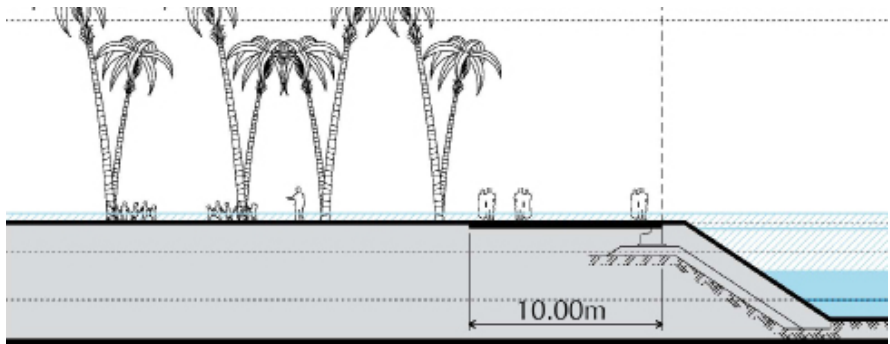


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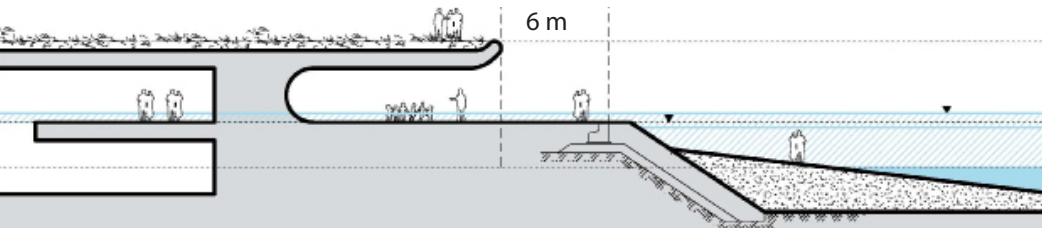
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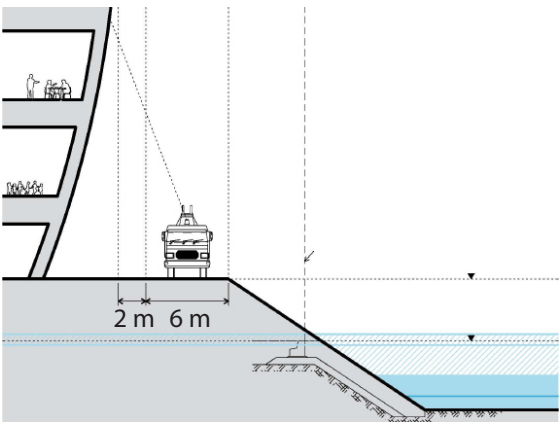
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Reports/Entertainment Island/366_REP-1_101025_S-Deliverables

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Reports/Entertainment Island/366_REP-1_101025_S-Deliverables

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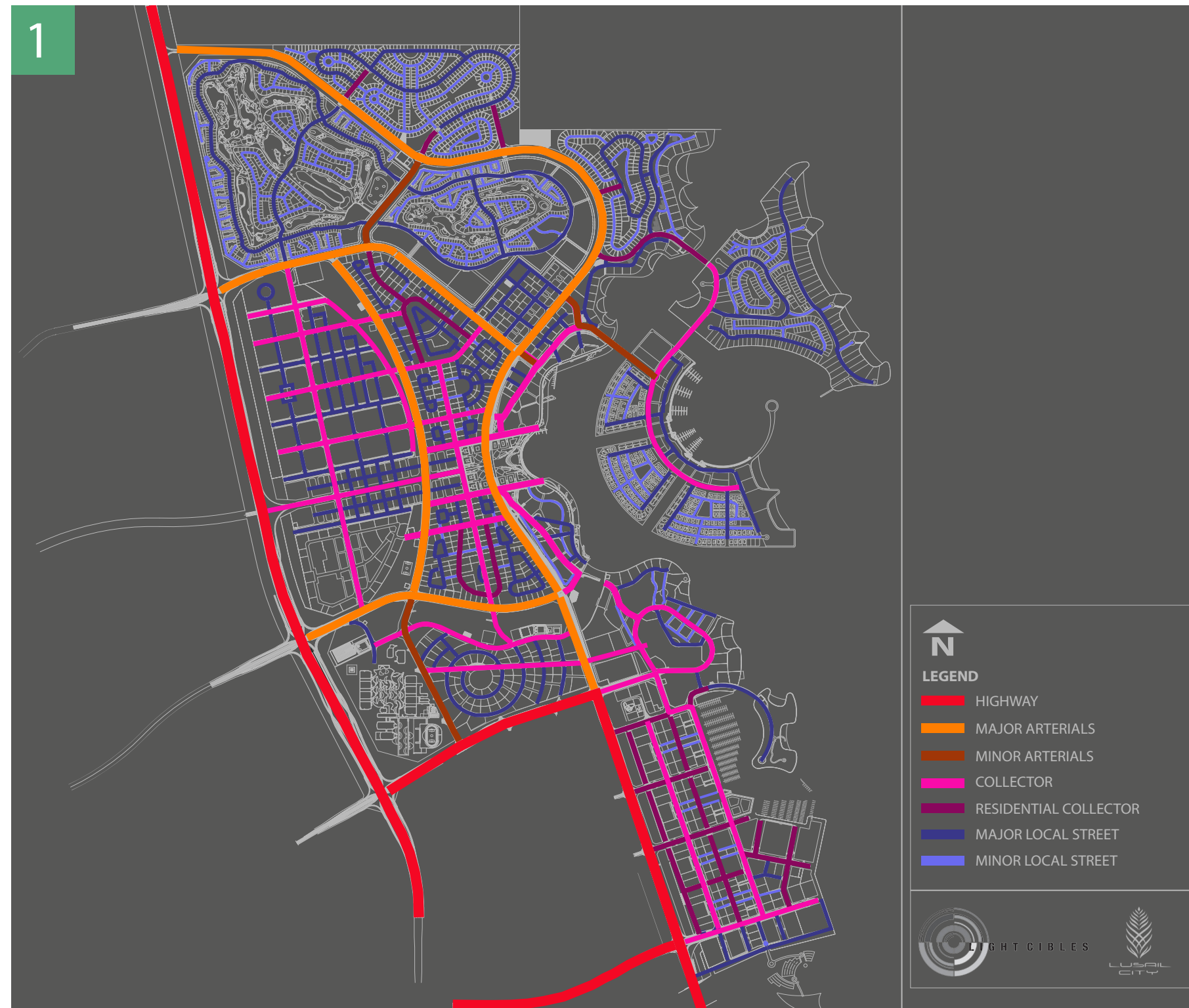
2.1.2. Road Hierarchy

The hierarchy map displays the arrangement of the city's streets in ranked or graduated series. This helps classify information to be analyzed into certain categories.

The hierarchy map provides a visual representation of the streets and their subordinate relationships among each other, portraying the overall breakdown of Lusail.

The physical characteristics of the street and roads, determine the lighting specifications according to the most important technical recommendations from different countries.

These specifications are the “must”, which represent the complex of technical requirements necessary for every specific area according to its function and characteristics.

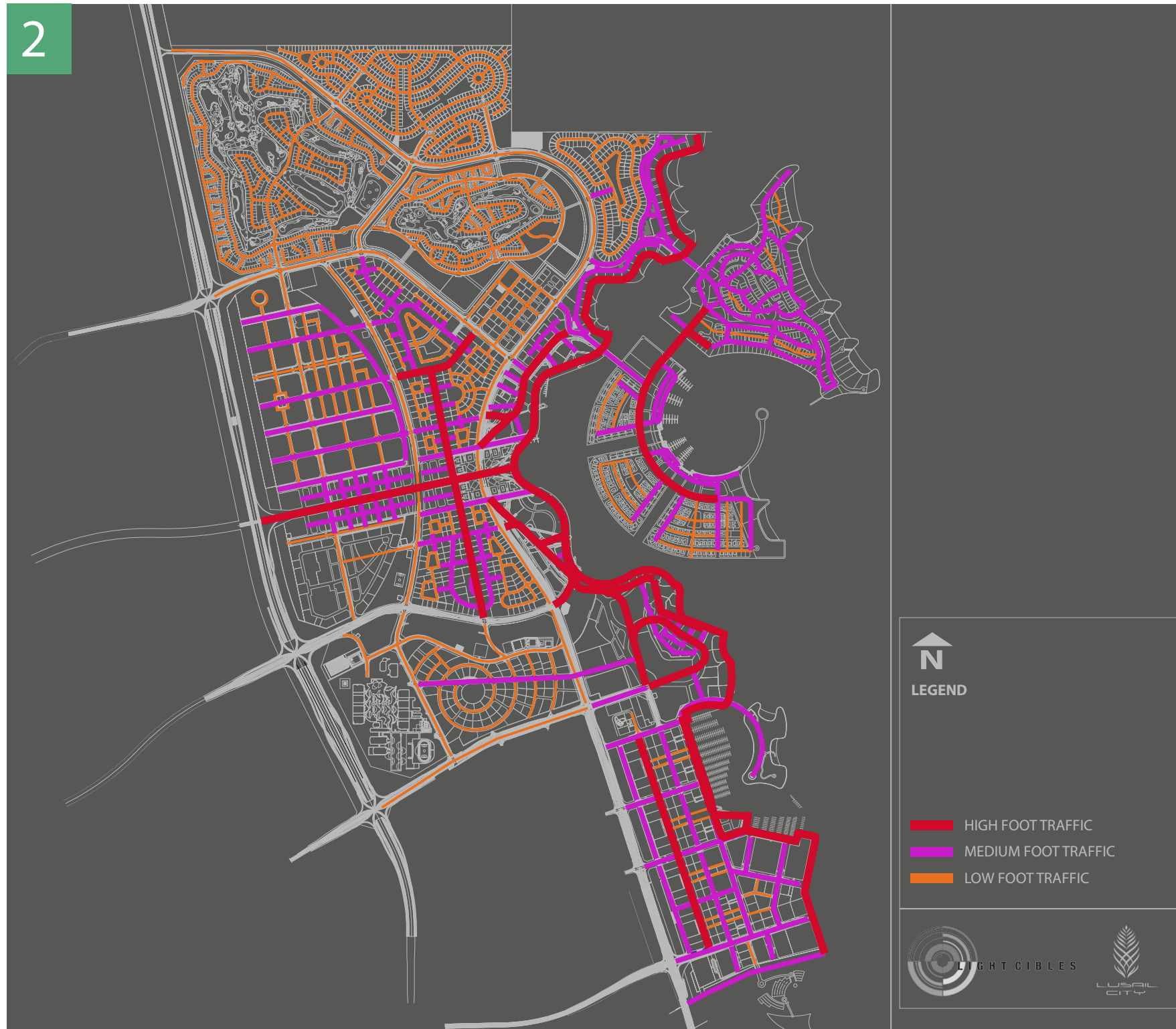


Road Hierarchy Map

2.1.3. Pedestrian Route Traffic

The analysis of the pedestrian routes layout allows us, to recognize 3 different hierarchies; high, medium and low foot traffic, this classification has a direct relation with the road network hierarchy, which allows us to design a proper luminous environment, considering both aspects.

One of the principal's issues in pedestrian lighting is to provide proper orientation within the area and allow quick and accurate identification of streets and houses.



Pedestrian Route Traffic Plan Map

2.1.4. Cycle Route Plan

The cycle route plan, as the same in the public transportations, shows us, some lighting opportunities, the cycle parking. These elements could be from public art features to just functional spaces. In both cases the luminous environment must achieve the norm lighting levels and ensure safety and prevent theft.

In the cycle roads, the lighting objective is to optimize visibility and security aspects.



Cycle Route Plan Map

2.1.5. Gateways & Landmarks

Gateways

Gateway features are important elements in the identification of Lusail. They are used to announce and celebrate arrival, create a sense of place and convey the image of the development.

Landmarks

These distinctive elements in the urban layout are important buildings, with strategic locations.

Landmark buildings have been identified to reinforce visual sight line connections along major streets.

The lighting design, of these buildings is going to be a monumental strategy, to increase their character and recognition of them.



Gateways & Landmarks

2.1.5.1. Waterfront Landuse and Architecture

There are different ways to illuminate the public space of the city, closely related to population density, activity and landuses that are developed in each area.

The morphology of buildings and especially their height are determining factors when we approach a study of urban lighting.



Landuse Map

2.1.5.2. Architectural Guidelines related with Facade Lighting

Materials:

Podium

- Cladding systems with natural stone as the primary material - granites, sandstone, lime stone, accented with dark timber in patterns that highlight important features of the building. Color to complement the towers system.

Tower

- Cladding systems in natural stone or metal and spandrel cladding panels accented with polished stone or steel panels.
- Textures and colors should be used in moderation to highlight accents and create emphasis.
- Rhythmic pattern or alignment of panel joints is encouraged.

Fenestration and Glazing

- Provide a window to wall ratio of 50% as the maximum allowable ratio of glazing on any single façade.
- Glazing for exterior walls shall provide high visible light transmittance ($\geq 40\%$) and low external reflectance ($\leq 25\%$) subject to satisfactory resolution of the energy performance requirements of the building envelope.

Color Aim:

- Bright or intense colors or very dark colors should be used sparingly or as secondary themes. They should typically be reserved for more delicate or intricate design elements such as grille work or more transient features such as awnings, signs and flags.
- Materials with natural colors such as brick or copper should be left unfinished unless there is a compelling reason to the contrary.
- Natural stone colors of red, beige, cream, and grey should predominate. Darker or lighter hues could be used as accent trim.



Marina District.



Waterfront Residential.



Al Kharaej



Lusail Towers.



Qetaifan Islands.



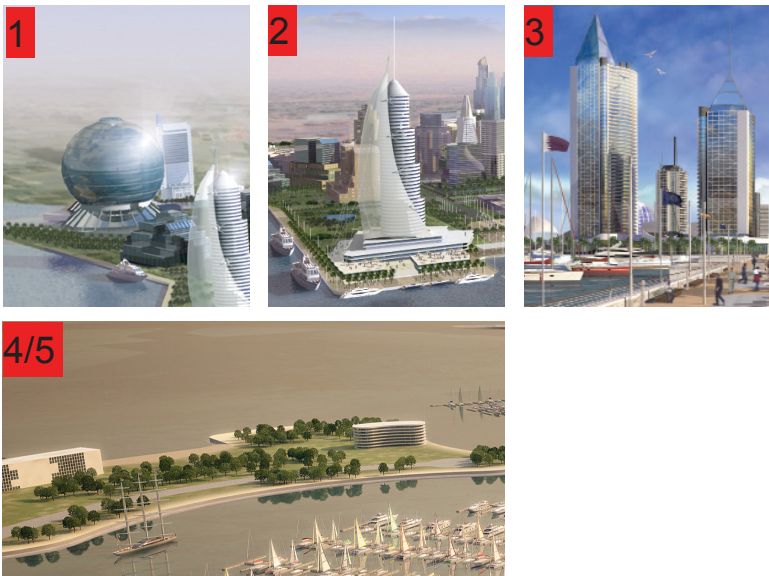
Commercial Boulevard.

2.1.5.3. Skyline Analysis

MARINA DISTRICT &
ENTERTAINMENT ISLAND



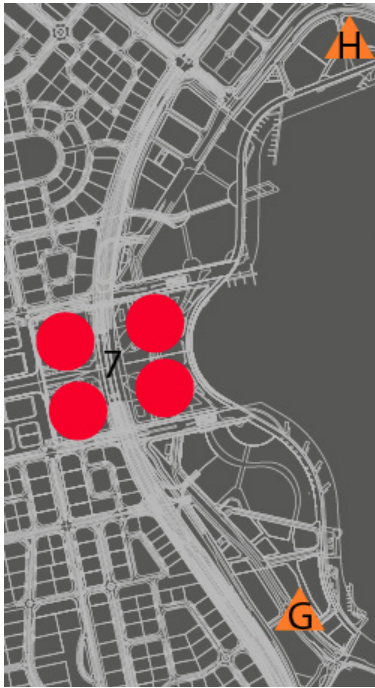
Landmarks



Gateways



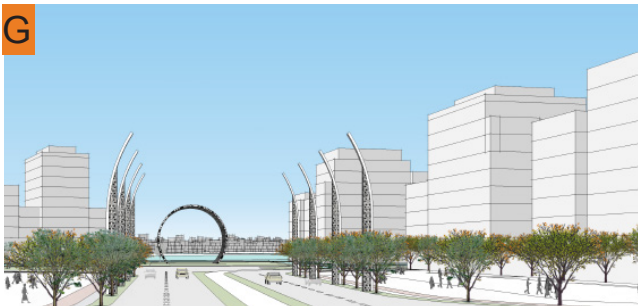
SEEF LUSAIL AND LUSAIL PLAZA



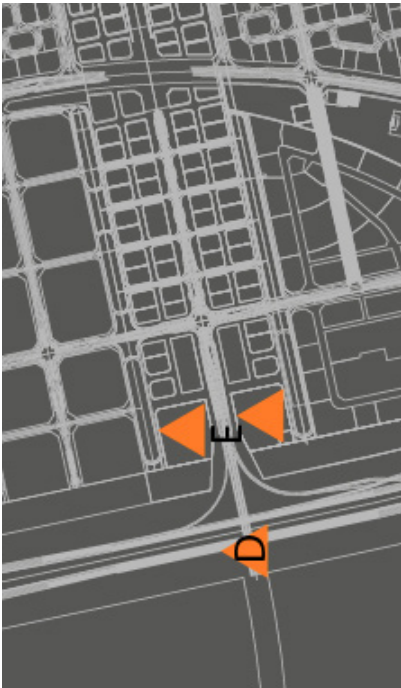
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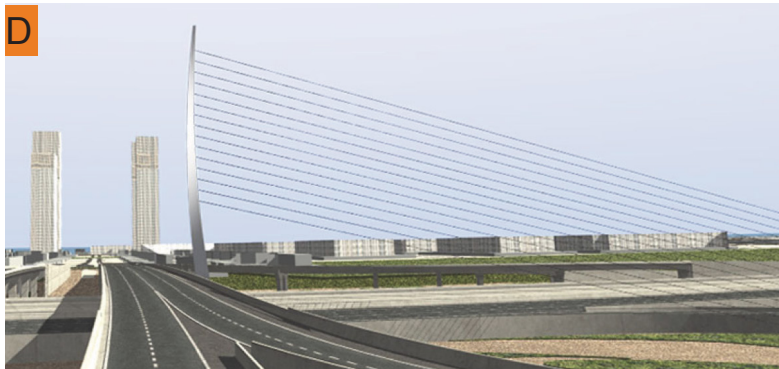
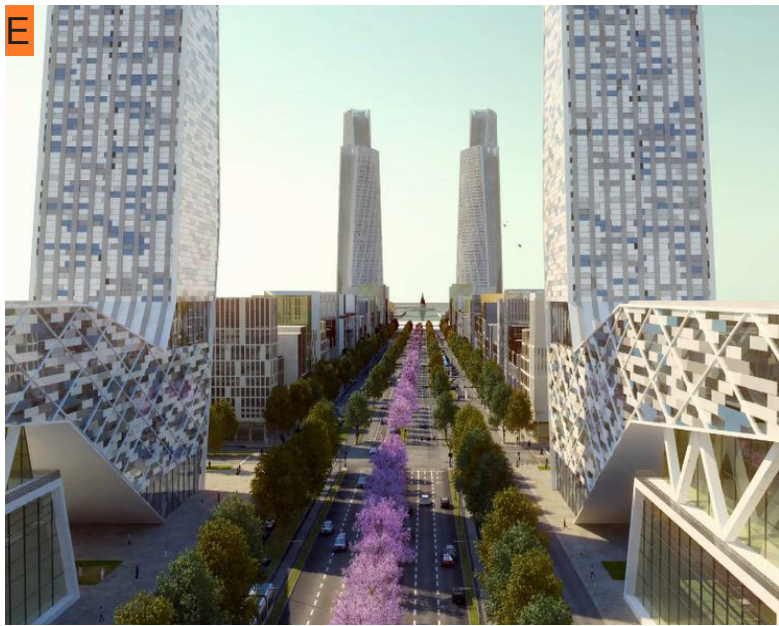
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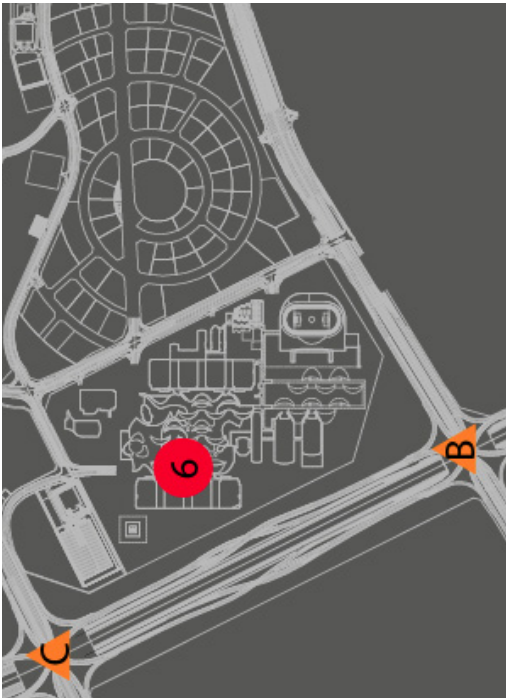
COMMERCIAL BOULEVARD



Gateways



ENERGY CITY



Landmarks



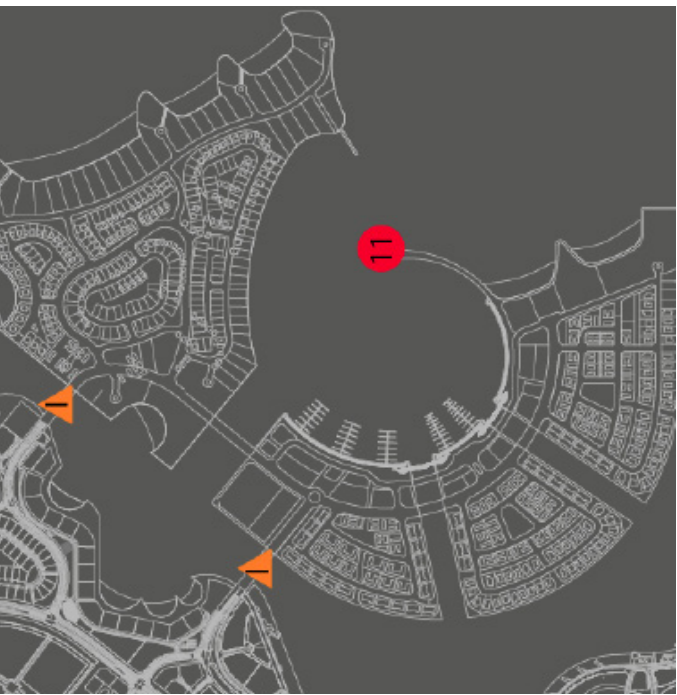
WATERFONT RESIDENTIAL



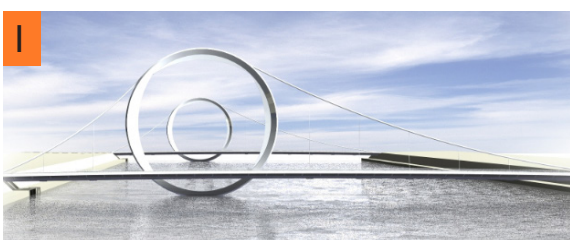
Landmarks



QETAIFAN ISLANDS



Gateways



Landmark



2.1.6. Landscape

The presence of trees and shrubs in urban environments add a special character to the mood of the space. For this reason the lighting design of these special elements has to be carefully studied in order to integrate them in the general atmosphere characteristic of the area.

Analyzing the landscape plan, we recognize 3 minor parks and the great park, in all these, pedestrian have a protagonist roll, and a special lighting environment will care about this relation.

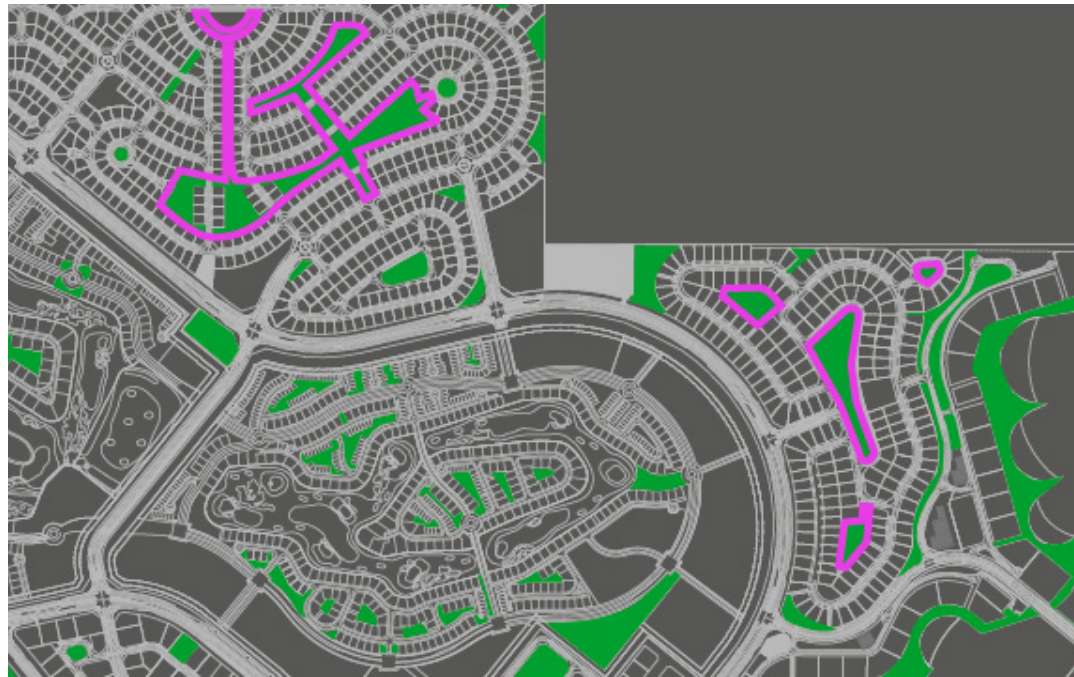
There are numerous trees in all the master plan, where the lighting master plan has to be careful about distance and disposition of lighting elements.



Landscape Map

2.1.6.1. North Residencial Park

Meeting and recreation place



Recreation Lawn



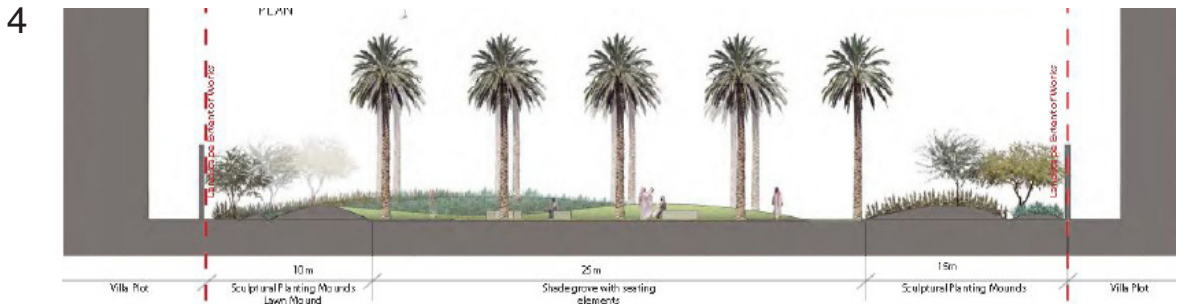
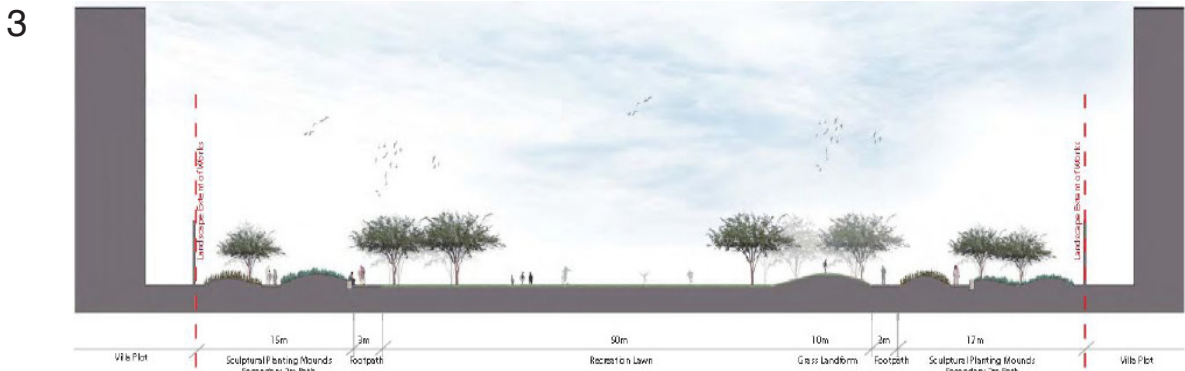
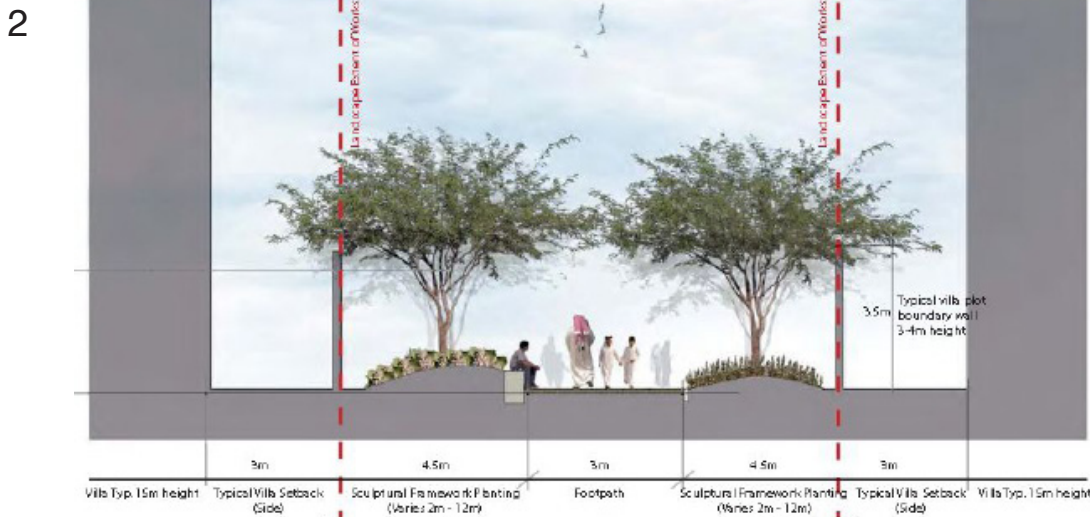
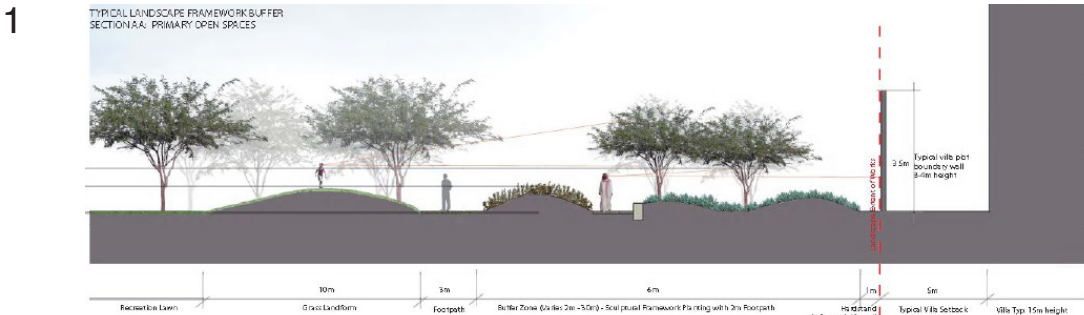
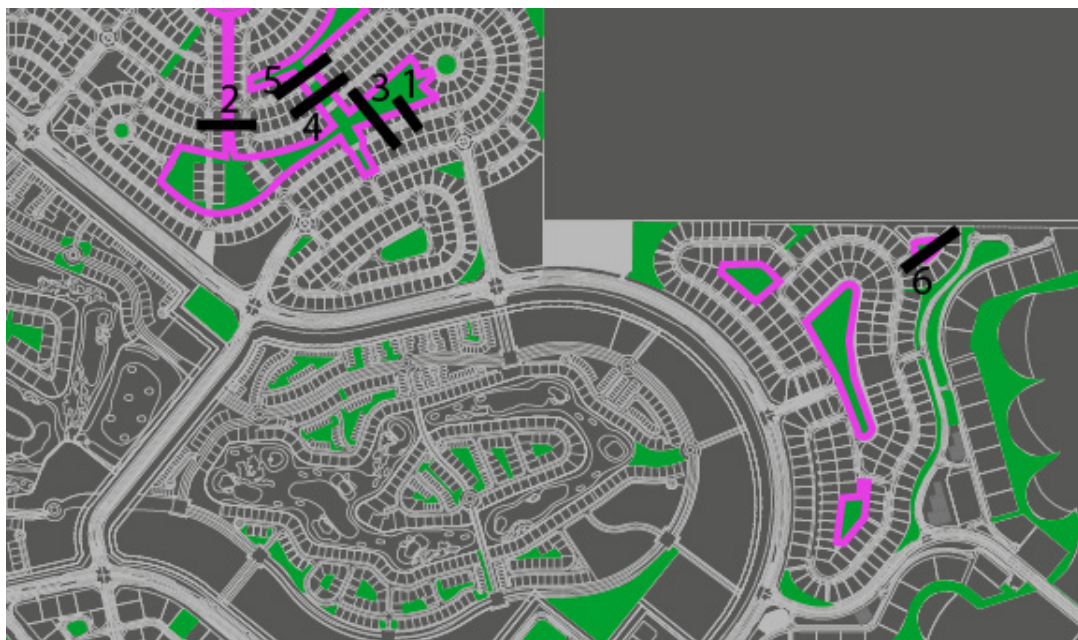
Plaza with shadow canopies



Garden pocket with water feature



Shade grove



2.1.6.2. Al-Khor Park



Enlargement area 2



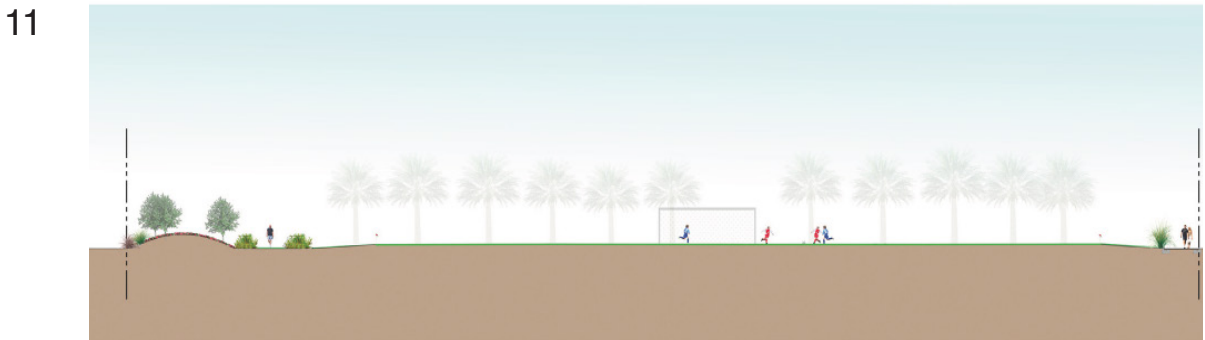
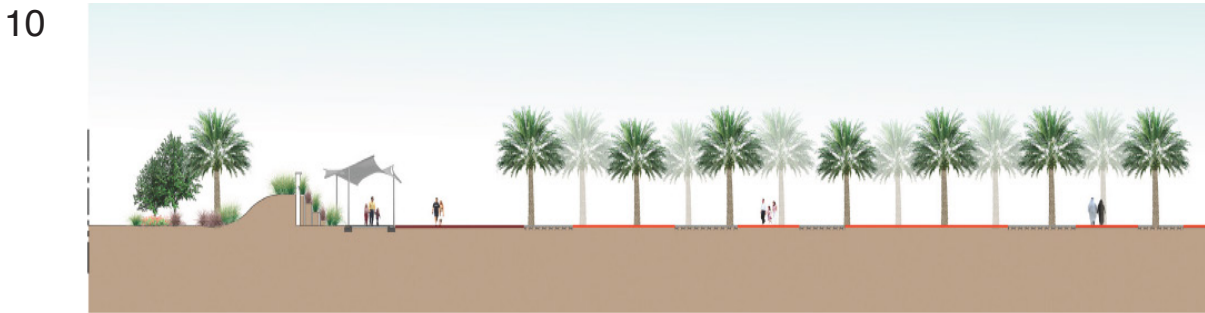
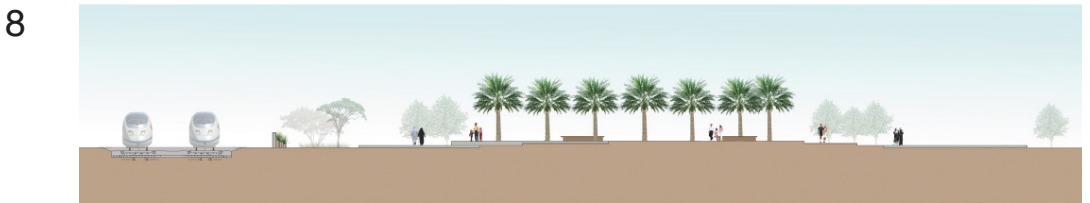
Sports pitch



Enlargement area 3



Enlargement area 3



2.1.6.3. Crescent Park North and South



Recreation Lawn



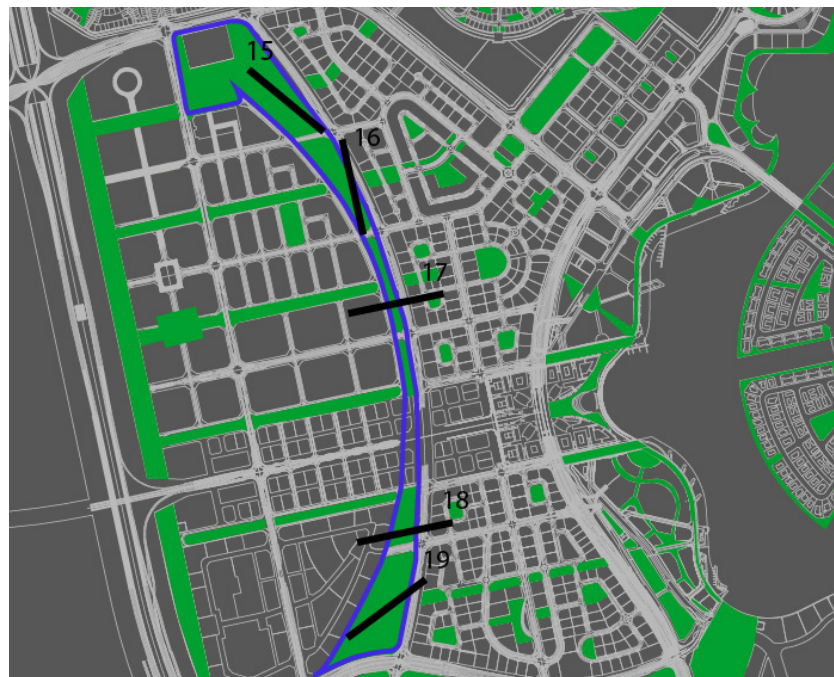
Plaza with shadow canopies



Garden pocket with water feature



Shade grove



15



16



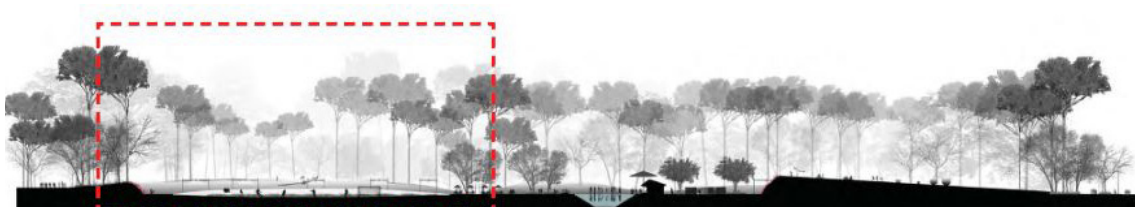
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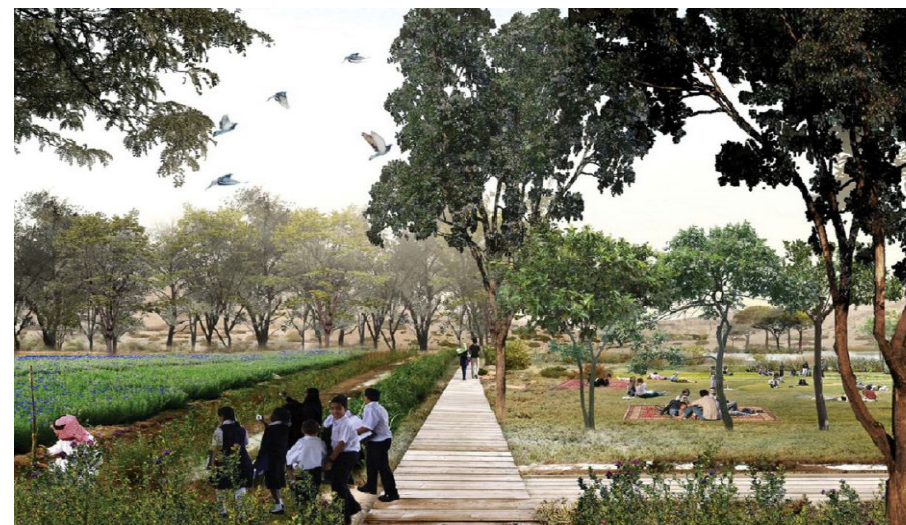
2.1.6.4. Wadi



Wadi arid upland



Wadi wetland



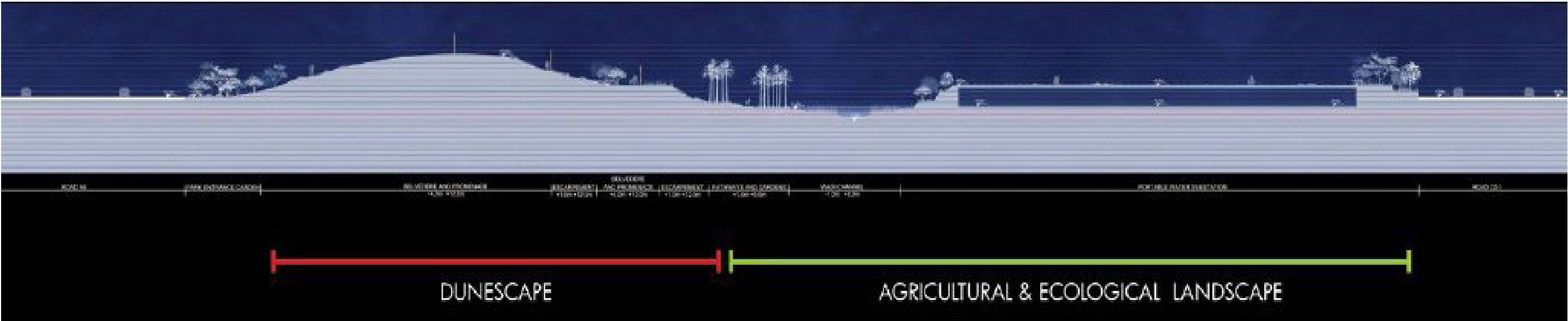
Wadi arid upland



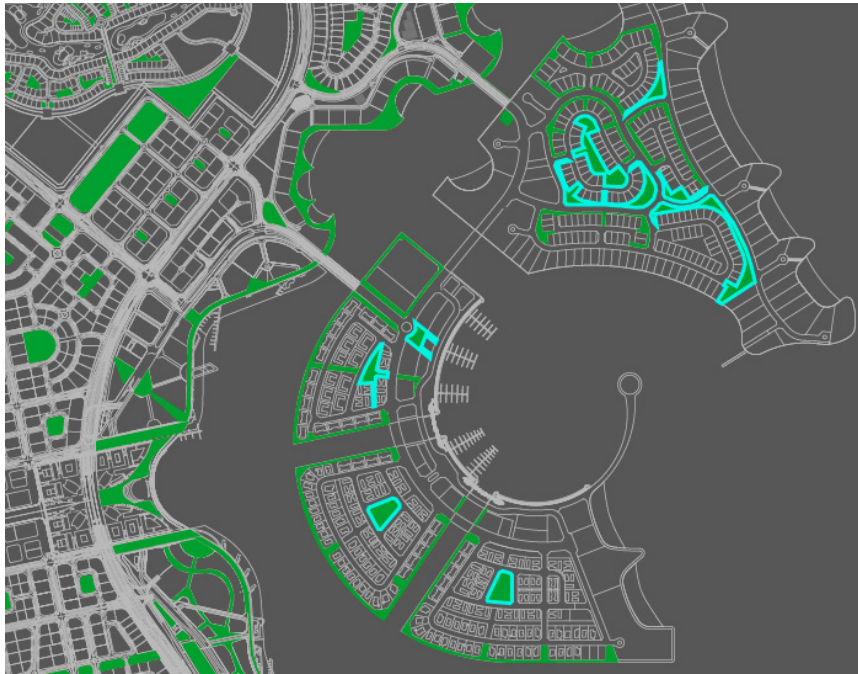
Aerial perspective



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2.1.6.5. Qetaifan Island Park



* This images do not correspond with the last plan version.



View of the Qetaifan Island Park

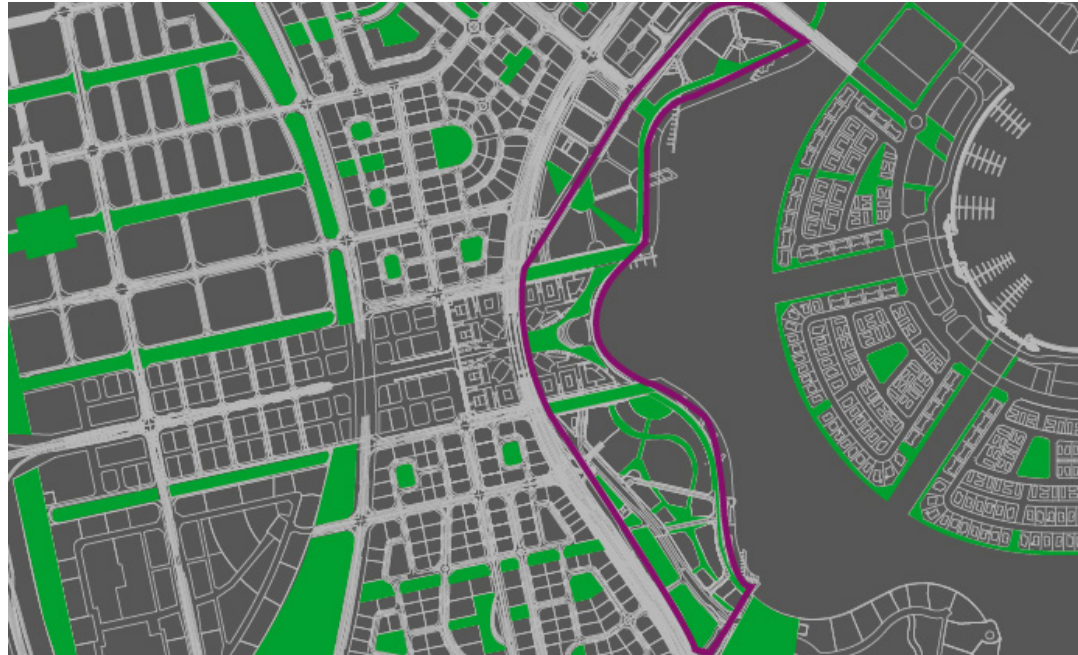


Aerial perspective



Aerial perspective

2.1.6.6. Seef Lusail Park



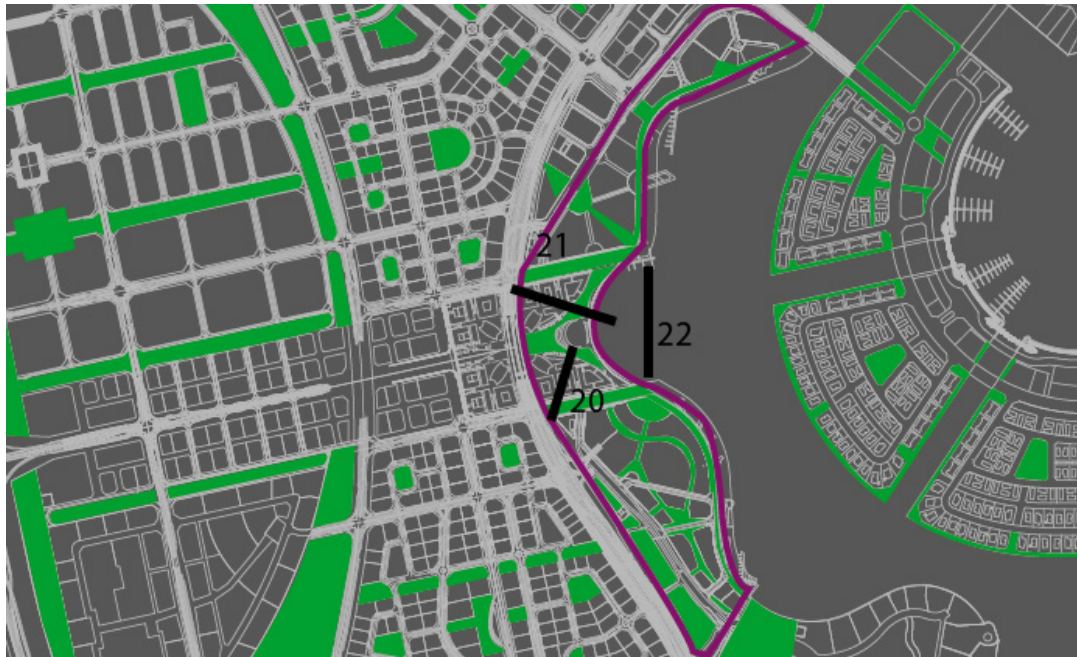
View of the Lusail plaza park



View of the Lusail plaza park



View of the Lusail plaza park



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2.1.6.7. Entertainment City Park

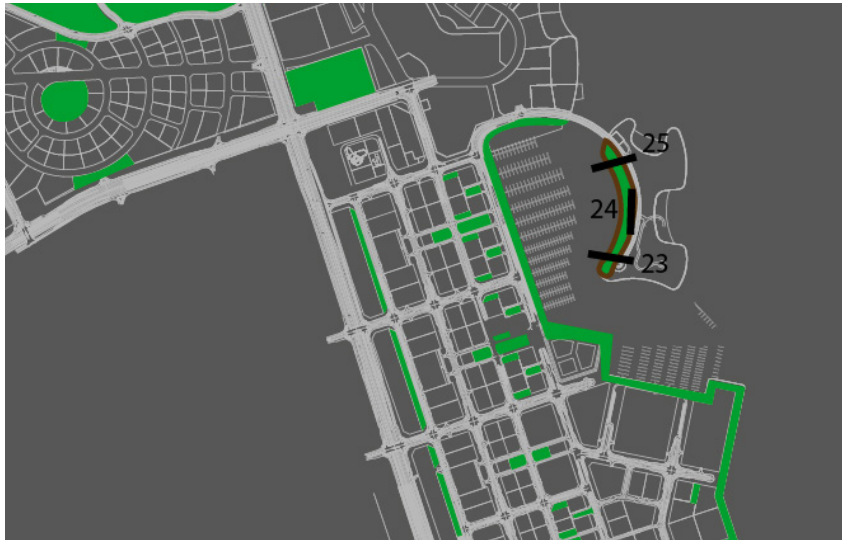


Aerial perspective



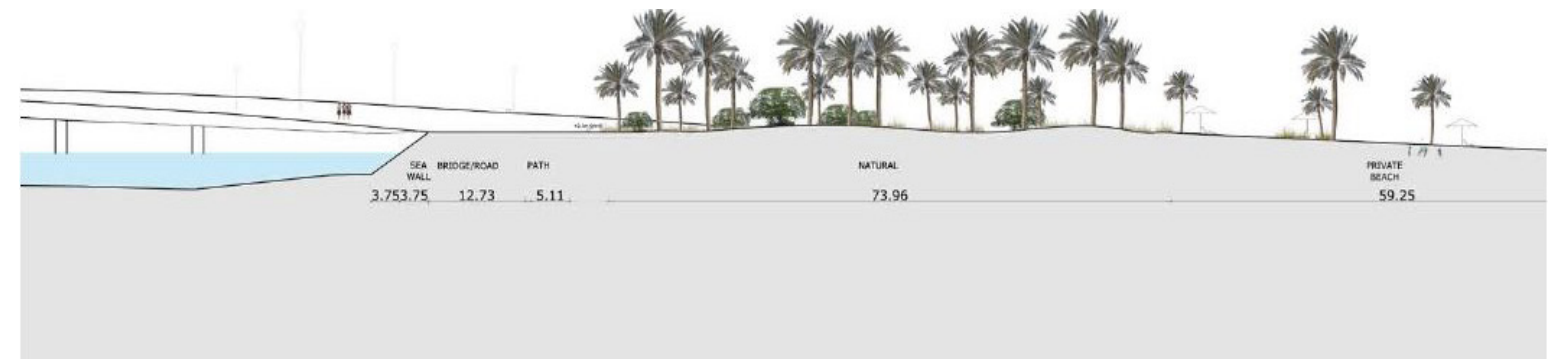
View of the Qatar entertainment park

2.1.6.8. Entertainment Island Park

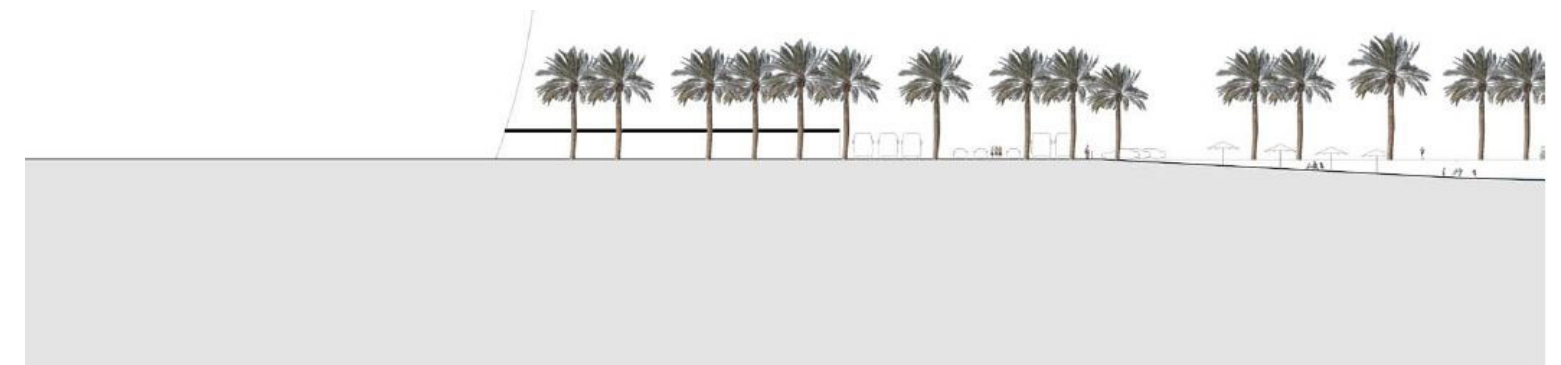


Aerial perspective

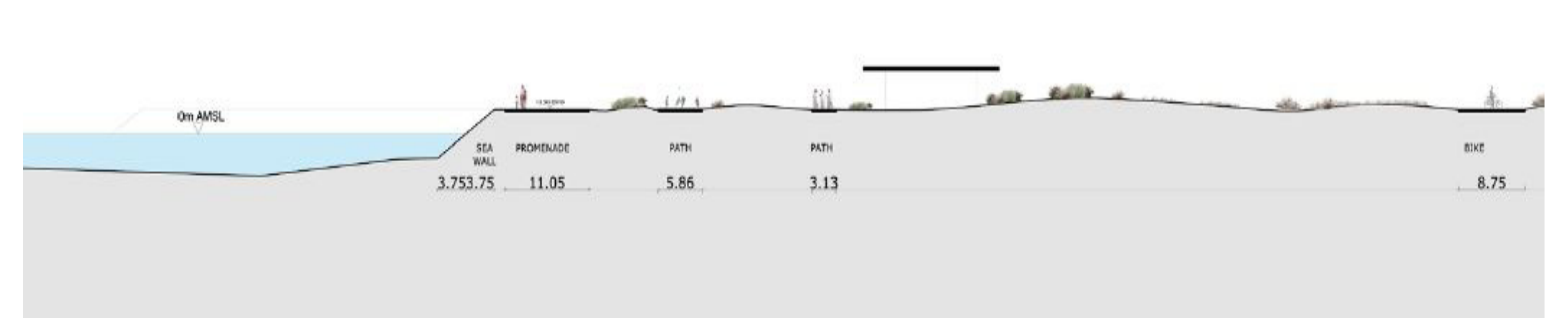
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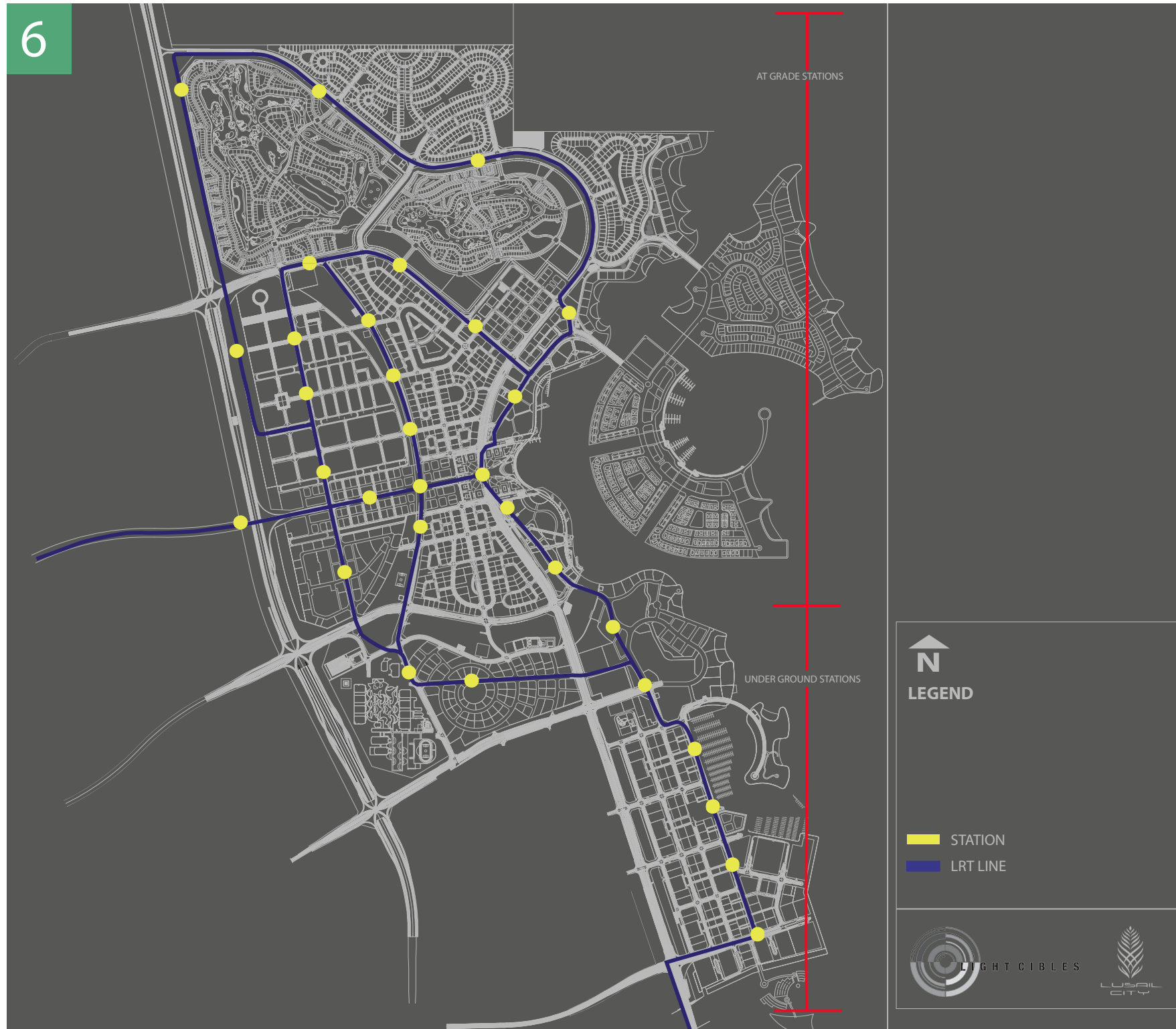
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2.1.7. Public Transportation

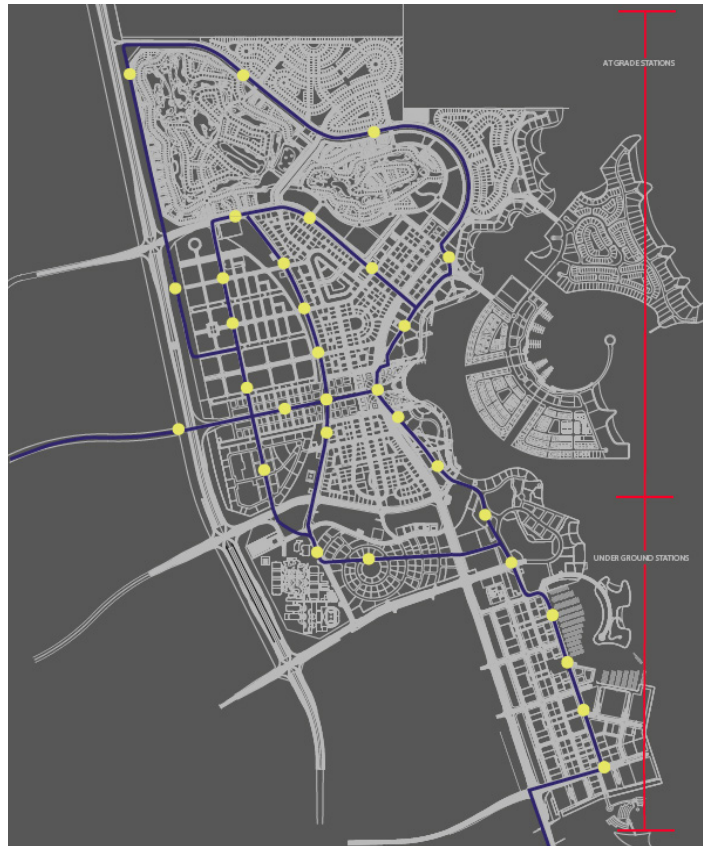
The analysis of the public transportation layout, allows us to identify the concentration nodes in the LDREC Master plan. This creates very specific lighting opportunities (shuttle, bus stop & taxi stands).

These urban elements concentrate big amounts of people on their surroundings, that's why we have to provide the correct balance of functional lighting for safety / security, and a pleasant ambience.

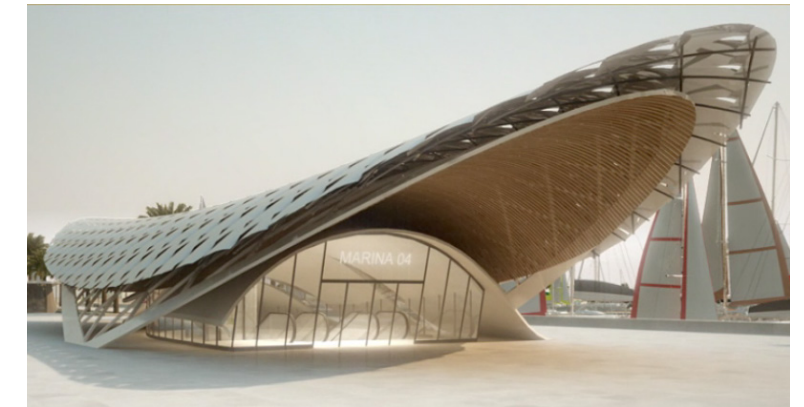


Public Transportation Map.

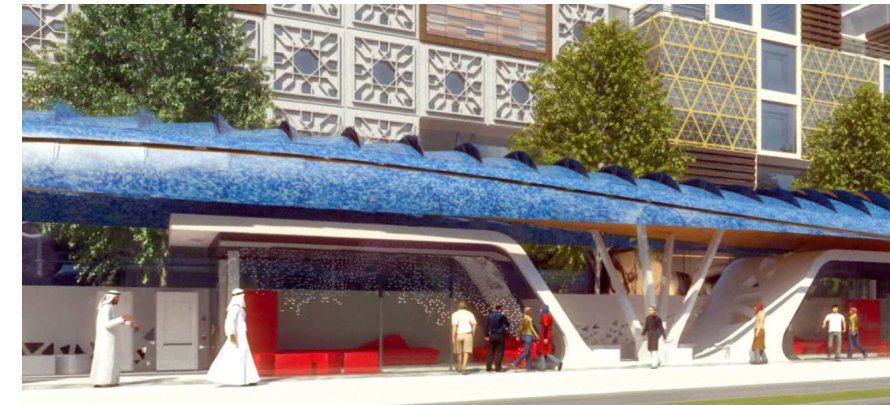
2.1.7.1. Public Transportation



Marina District.



Commercial Boulevard.



Lusail Plaza.



3. NORM / MUST: TECHNICAL RECOMMENDATIONS

3.1. Introduction

Studies have established a substantial relationship between good fixed lighting and traffic safety.

The principal purpose of roadway lighting is to produce quick, accurate, and comfortable visibility at night. These qualities of visibility may safeguard, facilitate, and encourage vehicular and pedestrian traffic.

Every designer should provide for those inherent qualities required by the user. A very important consideration is that making streets and highways useful during hours of darkness as well as during the day-time. Where good visibility is provided through lighting, efficient night use can be made of the large investments in roadways and motor vehicles.

3.2. Lighting Glossary

The following lighting definitions help to understand the terms used in the technical requirements. These are the tools to fix lighting levels.

Luminance

The luminance determines how bright the road is by determining the amount of light reflected from the pavement in the direction of the driver. It is measured in candelas per square meter (Cd/m²).

Illuminance

Determines the amount of light incident on the roadway surface from the lighting system. Because different pavements have various characteristics, different illuminance levels are needed for each type. Is measured in 'Lux' or lumens per square meter (lm/m²).

Uniformity

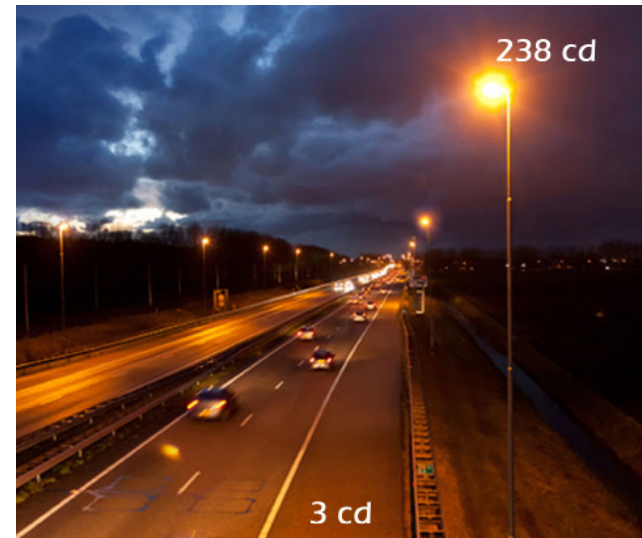
Uniform lighting allows us to perceive the environment continuously and without sudden breaks caused by lighting level drops

Glare

Visual sensation caused by excessive and uncontrolled brightness. It can be disabling or simply uncomfortable. It is subjective, and sensitivity to glare can vary widely.

Contrast

Difference in luminance and/or color that makes an object distinguishable. In visual perception of the real world, contrast is determined by the difference in the color and brightness of the object and other objects within the same field of view.



1. Luminance intensity: without cut off light system



2. Luminance intensity: with cut off light system



3. Luminance intensity: Architecture.



4. Luminance intensity: Architecture.



6. Glare.



5. Glare and Contrast.

3.3. Lighting Objectives

GENERAL PRINCIPLES

The primary function of Road Lighting is to reveal all the features of the road, these can include the limits of the carriageway and the footway, obstructions and defects in the road, and the presence and characteristics of other road users, also can contribute to commercial and social use at night of town centres and tourist locations.

The three most important Norms of the world are:

CIE. Comission Internationale de L'eclairage. The Central Bureau located in Vienna, Austria, with comprised of 38 member bodies. Argentina, Australia, Belgium, Canada, China, Denmark, France, etc.

IESNA. Illuminating Engineering Society Of North America. The Society is still headquarter in New York. With comprised of Canada, USA, Mexico, Alaska.

EN / BS. European Committee for Standardization. Was officially created in Brussels. With Comprised of European Union Countries.

QHDM. Qatar Design Manual for Lighting Standardization. Was officially created in January 1997.

What is a standard

It is a published document that contains technical specifications or other precise criteria designed to be used as rule, guideline or definition. Standards help to increase the reliability and services we use.

SCOPE

This document offers a selection of lighting aspects and recommendations which is applicable to provide good visibility to users of outdoor traffic areas during the hours of darkness and support the traffic safety, traffic law and public security.

To develop Lusail have gathered different aspects and levels of illumination of each standard and obtained valuable information which will be developed for our project

LIGHTING CONCEPTS

Luminance

The luminance determines how bright the road is by determining the amount of light reflected from the pavement in the direction of the driver. It is measured in candelas per square meter (Cd/m²).

Illuminance

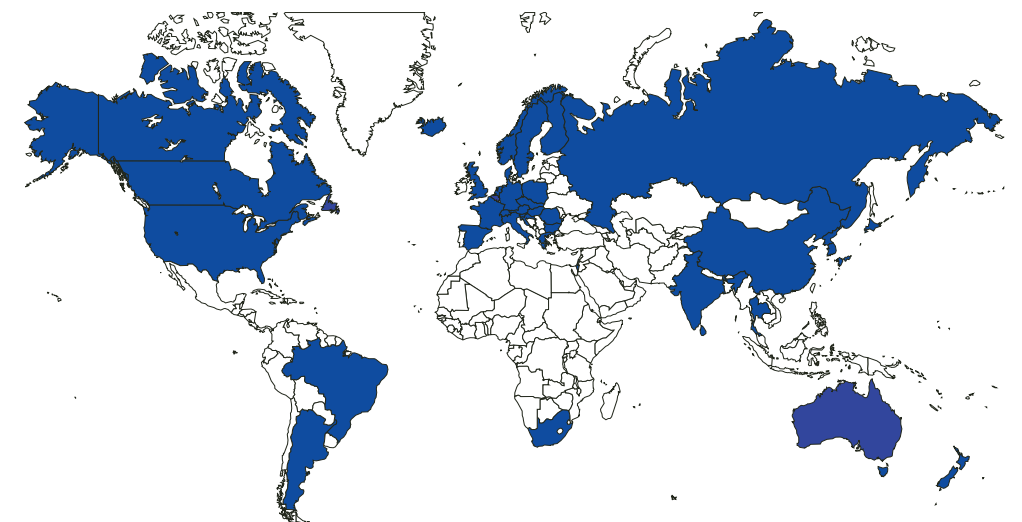
Determines the amount of light incident on the roadway surface from the lighting system. Because different pavements have various characteristics, different illuminance levels are needed for each type. Is measured in 'Lux' or lumens per square meter (lm/m²).

Uniformity

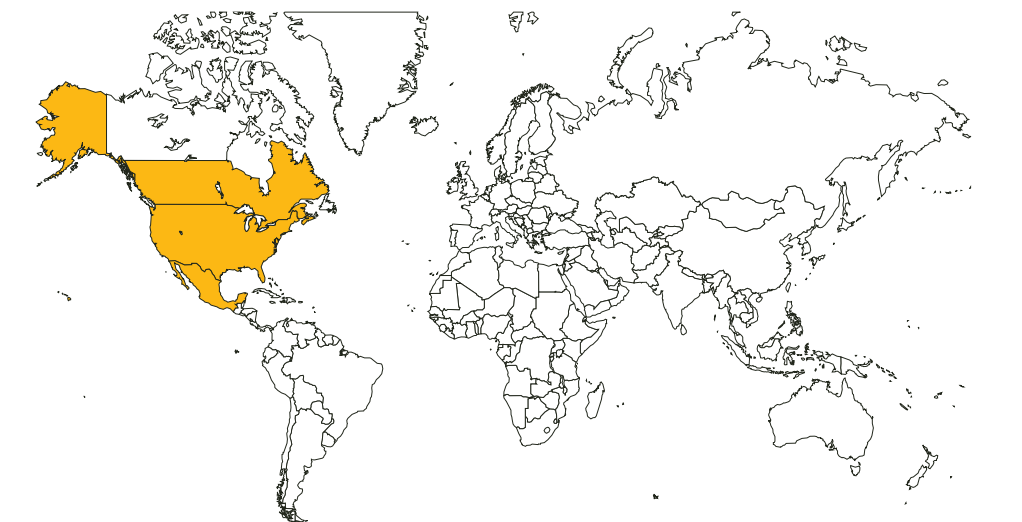
Uniform lighting allows us to perceive the environment continuously and without sudden breaks caused by lighting level drops



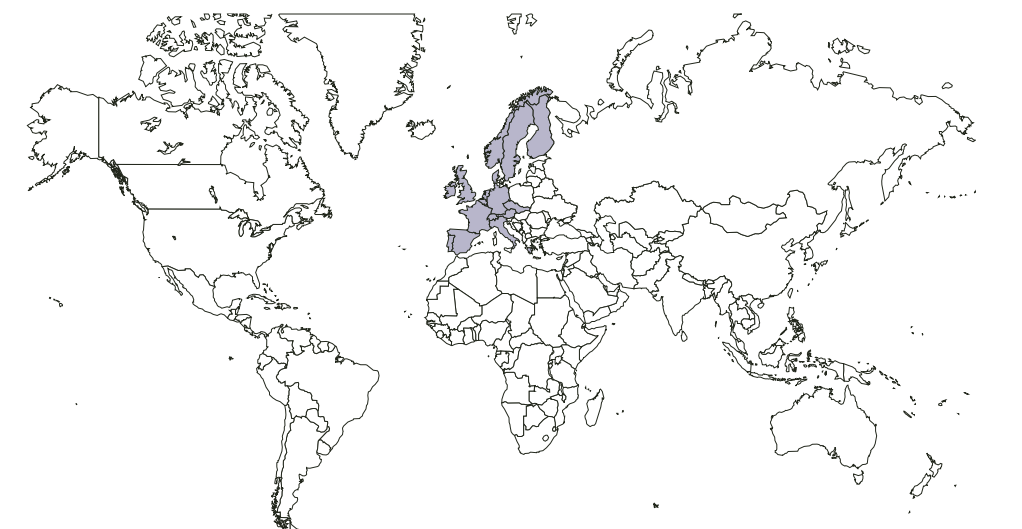
CIE Members



IESNA Members



European Standard Members



3.4. Results for Roads

LUSAIL - DOHA - QATAR																																			
T Y P E O F R O A D	R O A D	L I G H T I N G C L A S S	NORMS				NORMS				NORMS				NORMS				NORMS				NORMS												
			C I E	I E S N A	B S / E N	Q A T A R	C I E	I E S N A	B S / E N	Q A T A R	C I E	I E S N A	B S / E N	Q A T A R	C I E	I E S N A	B S / E N	Q A T A R	C I E	I E S N A	B S / E N	Q A T A R													
			1 1 5	H A N D B O O K	1 3 2 0 1	H I G H W A Y D E S I G N	1 1 5	H A N D B O O K	1 3 2 0 1	H I G H W A Y D E S I G N	1 1 5	H A N D B O O K	1 3 2 0 1	H I G H W A Y D E S I G N	1 1 5	H A N D B O O K	1 3 2 0 1	H I G H W A Y D E S I G N	1 1 5	H A N D B O O K	1 3 2 0 1	H I G H W A Y D E S I G N													
			2 0 1 0				2 0 1 0				2 0 1 0				2 0 1 0				2 0 1 0			2 0 1 0													
HIGHWAY	(64m)		M5	R3/FREEWAY	A3ME3B	A		0,5cd/m2	0,9cd/m2	1cd/m2	2,5			9,0lx				0,35	0,3	0,4	0,4														
MAJOR ARTERIALS	(40m)		M3	R3/MAJOR/HIGH	A3ME4B	B		1cd/m2	1,7 cd/m2	0,75cd/m2	2,0			17lx				0,4	0,3	0,4	0,4														
MINOR ARTERIALS	(32m)		M3	R3/MAJOR/MEDIUM	A3ME2	B		1cd/m2	1,3cd/m2	1,5cd/m2	2,0			13lx				0,4	0,3	0,4	0,4														
COLLECTOR	(24m)		M2	R3/COLLECTOR/HIGH	A3ME3B	C		1,5cd/m2	1,2cd/m2	1,0cd/m2	2,0			12lx				0,4	0,4	0,4	0,4														
RESIDENTIAL COLLECTOR	(20m - 16m)		P1	R3/COLLECTOR/MEDIUM	D3S3	D1			0,9cd/m2		1,25			15lx	9,0lx	7,5lx			0,4		0,4			3,0lx		1,5lx			15lx		7,5lx				
MAJOR LOCAL STREET	(16m)		P2	R3/LOCAL/HIGH	D3S3	D1			0,9cd/m2		1,25			10lx	9,0lx	7,5lx			0,4		0,4			2,0lx		1,5lx			10lx		7,5lx				
MINOR LOCAL STREET	(<16m)		P3	R3/LOCAL/MEDIUM	D3S4	D2			0,7cd/m2		0,75			7,5lx	7,0lx	5,0lx			0,4		0,4			1,5lx		1,0lx			7,5lx		5,0lx				

- QSAS Standards are requesting 2 to 5 times more lightng level than CIE.
- Light Cibles highly recommends to follow the CIE standards in order to reduce the power consumption of the roads and later on the building facade as well.



3.5. Hierarchy Map

MUST: Technical Recommendations

The hierarchy map provides a visual representation of the streets and their subordinate relationships among each other, portraying the overall breakdown of Lusail Urban grid.

The physical characteristics such as the section of the streets will determine the lighting specifications. These specifications are the “must”, which represents the complex of technical requirements necessary for every specific area according to its function and characteristics.

HIGHWAY

Lighting Classes for motorized traffic		
Lav cd/m2	Eav lx	Uo
2.5		0.4

* QSAS reference.

MAJOR / MINOR ARTERIAL

Lighting Classes for motorized traffic		
Lav cd/m2	Eav lx	Uo
1.0	20	0.4

COLLECTOR

Lighting Classes for motorized traffic		
Lav cd/m2	Eav lx	Uo
1.5	15	0.4

RESIDENTIAL COLLECTOR

Lighting Classes for motorized traffic		
Lav cd/m2	Eav lx	Uo
	15	0.4

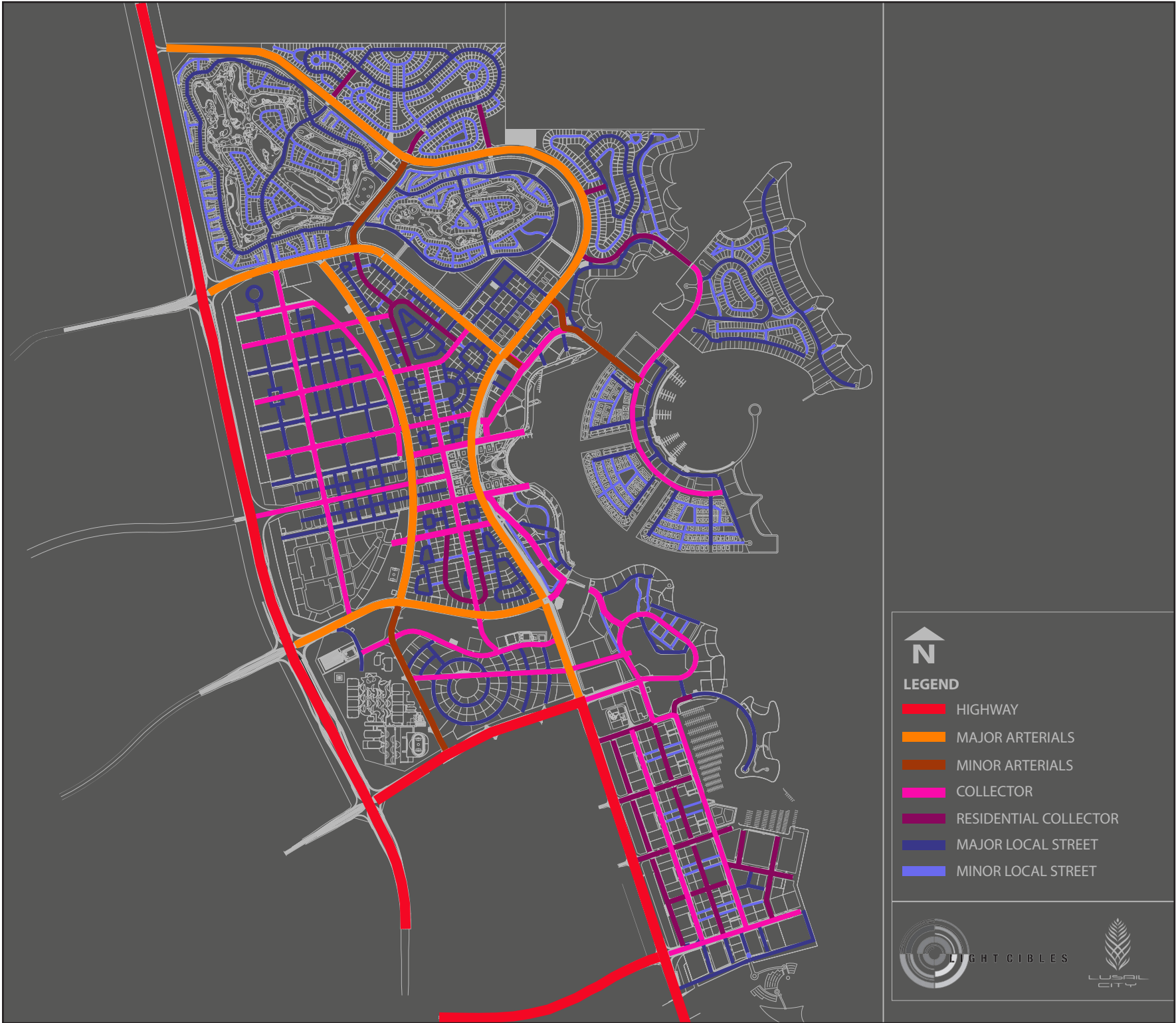
MAJOR LOCAL STREET

Lighting Classes for motorized traffic		
Lav cd/m2	Eav lx	Uo
	10	0.4

MINOR LOCAL STREET

Lighting Classes for motorized traffic		
Lav cd/m2	Eav lx	Uo
	7,5	0.4

* CIE reference.



Hierarchy map based on Road Network Hierarchy Plan

3.6. Results for Pedestrian Paths

LUSAIL - DOHA - QATAR																									
T Y P E O F P E D E S T R I A N	L I G H T I N G C L A S S	NORMS				L E V E L S I L L U M I N A N C E I X	NORMS				U N I F O R M I T Y U o	NORMS				C Y C L E M I N I M U M L E V E L S	NORMS				C Y C L E A V E R A G E L E V E L S	NORMS			
		C I E	I E S N A	B S / E N	Q H D M		C I E	I E S N A	B S / E N	Q H D M		C I E	I E S N A	B S / E N	Q H D M		C I E	I E S N A	B S / E N	Q H D S					
		1	H	1			1	H	1			1	H	1			1	H	1			1	H		
		1	A	3			1	A	2			1	A	2			1	A	2			1	A		
		5	O	2			0	O	0			1	O	1			0	O	1			0	O		
2																									
0	K	0																							
1																									
0																									
PRIMARY		P1	LOCAL/HIGH	E1CE1A			15lx		15lx	25lx			0,4	0,4			3,0lx		5,0lx			15lx		15lx	
SECONDARY		P2	LOCAL/MEDIUM	E1CE2			10lx	14lx	10lx				0,4	0,4			2,0lx		3,0lx			10lx		10lx	
TERTIARY		P3	LOCAL/LOW	E1S3			7,5lx	7,5lx	7,5lx				0,4				1,5lx		1,5lx			7,5lx		7,5lx	

- QSAS is not recommending any light level for pedestrian.
- Light Cibles is recommending to follow the CIE standards.



3.7. Pedestrian Areas

MUST: Technical Recommendations

Paths are specifically provided to allow pedestrian access from parking lots to shopping and recreation areas, paths which link residential complexes to areas of communal gatherings and paths through parks.

The principal aspect to achieve in pedestrian lighting is security feeling and comfort, that's uniformity is not a must in lighting design for the walkways.

To reach this pleasant pedestrian lighting we must avoid dark spots and any unnecessary glare.

HIGH FOOT TRAFFIC

Lighting for pedestrian and low speed traffic areas	
Eav lx	Emin lx
10 - 15	2 - 5

MEDIUM FOOT TRAFFIC

Lighting for pedestrian and low speed traffic areas	
Eav lx	Emin lx
7.5 - 10	1 - 3

LOW FOOT TRAFFIC

Lighting for pedestrian and low speed traffic areas	
Eav lx	Emin lx
5 - 7.5	1 - 2

* CIE reference.



Hierarchy map based on Pedestrian Network Hierarchy Plan

3.8. Results for Cycle Path

MUST: Technical Recommendations

A cyclist must negotiate his way in all types of weather without protection against the elements, and therefore viewing conditions at night have to be extremely good.

The positions of cycle paths will vary considerably within the site. They can be located alongside the road or completely separated from any other transport route such as through parks and open or wooded fields. Each situation must be considered individually and consideration be given to the suitability of using the lighting of an adjacent route for the cycle path.

As the main requirement of visibility will be the determination of changes to or the presence of objects on the pathway the concept of path surface horizontal illuminance are recommended as standards.

CYCLE PATH

Lighting for pedestrian and low speed traffic areas	
Eav lx	Emin lx
10 - 15	2 - 5

* CIE reference.



Hierarchy map based on Cycle Route Network Hierarchy Plan